Research Note 85-43

Job Skills Education Program: Design Specifications

Gayle T. Rayner
Florida State University

Lois S. Wilson
Hazeltine Corporation

Beatrice J. Farr
Army Research Institute

for

Instructional Technology Systems Technical Area
Zita M. Simutis, Chief

Training Research Laboratory
Harold F. O'Neil, Jr., Director

U. S. Army

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EDGAR M. JOHNSON
Technical Director

L. NEALE COSBY
Colonel, IN
Commander

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Job Skills Education Program (JSEP) is designed to provide soldiers with the prerequisite knowledge and skills required for successfully learning their Military Occupational Specialties (MOS). When the JSEP is put into effect, it will replace the Army's current Basic Skills Education Program (BSEP) with a sophisticated, computer-based system. This report covers three major topics: lesson design, learning strategies, and human factors. The lesson specifications are from RCA's (Continued)	

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job task analysis. The learning strategies section is a concept paper on how study skills, memory skills, self-pacing, and mood management can be integrated into the JSEP instruction. The human factors section details appropriate ergonomic considerations.

FOREWORD

The Job Skills Education Program (JSEP) is a multi-phase program begun in Fiscal Year 1982, and designed to enhance enlisted career potential by improving soldier job performance. The sponsor, the Education Division, Office of the Deputy Chief of Staff for Personnel, expects JSEP to replace the Army's current Basic Skills Education Program when it is implemented.

The JSEP program, being developed by Florida State University (FSU) will result in a standardized curriculum for soldiers who demonstrate deficiencies in the knowledge and skills required to successfully learn their Military Occupational Specialty (MOS).

In accordance with current policy, JSEP will be an on-duty program. It will also use a computer-based management system to facilitate an open entry/open exit approach. At present, most of the lessons being developed will be computer delivered; however, the plan calls for using existing materials, and incorporating materials developed as part of other ARI efforts, whenever appropriate.

A unique aspect of JSEP is that it builds upon a very detailed front-end analysis of MOS Baseline Skills. The analysis covered tasks performed by soldiers in the 94 highest density MOSs, in addition to Common Tasks (the skills that all soldiers, regardless of their MOS, need to know). Although the Army has over 300 MOSs, the 94 covered in the analysis represent about 80% of all soldiers. Perhaps the most useful product developed for the analysis was a taxonomy listing more than 200 prerequisite competencies.(P.C.) for these MOSs. The competencies were derived from detailed reviews of Soldier Manuals, and from extensive interviews with subject-matter experts at Army schools. This effort produced a series of tests intended to diagnose deficiencies in the P.C.s. Modified versions of these tests will be used in JSEP.

The JSEP program will include a front-end learning strategies module designed to improve soldier skills in reading, studying, test taking, and problem solving. The curriculum will consist of this strategies-training, plus 180 diagnostic review lessons, and 120 skill development lessons, which are being developed for the PLATO and MicroTICCIT computer systems. The program is being tried out at two TRADOC sites and two FORSCOM sites, prior to an Army-wide phased implementation.

JSEP: DESIGN SPECIFICATIONS

EXECUTIVE SUMMARY

Requirement:

The solicitation required that we:

> Adapt or adopt design specifications, including instructional specifications, engineering requirements, and human factors considerations.

To do that, we used, in part, the specified products from the US Army Training and Doctrine Command sponsored contract with RCA Educational Services (RCA) to conduct an extensive 94 Military Occupational Speciality (MOS) baseline skills analysis. A complete list of these contract products is presented in Appendix A.

This report details the work accomplished in Task 5 of the referenced contract.

Procedure:

The first steps following contract award were involved in planning the approach to the Job Skills Education Program (JSEP) design. Dr. Laverne Cook, the RCA Principal Investigator on the MOS Baseline Skills Analysis Project, visited a Florida State University (FSU) sponsored meeting of all principal project agencies to describe the RCA work. Subsequently, a team from Army Research Institute (ARI) and FSU visited RCA for a thorough two-day briefing on the details of each of the RCA contract products. Following this meeting, a plan evolved to integrate available RCA results and contract products into the JSEP design.

During the Task 1 in-process review, the project schedule was revised to accommodate the delayed delivery of RCA products. While it was possible to accommodate the initial delays in receiving RCA deliverables, subsequent delays required extensive project redesign. FSU began work on the lesson specifications and assigned the work for engineering and human factors to Hazeltine Corporation.

To insure prompt receipt of the RCA contract products, we issued a purchase order to RCA for duplication and mailing of each of their required analyses and reports. It was our initial plan to use RCA products to the fullest extent possible so that we could concentrate our resources on those aspects of JSEP unique to our contract.

Findings:

Based on the RCA Taxonomy (Appendix B), the initial FSU lesson specifications were developed on a selected sample of lessons thought to be representative of the total lesson population.

Some lessons, thought to be fairly typical, were carried through the lesson development procedure called for in the lesson specification. In order to model in a small way the procedure planned for the entire program, two lessons went through all the design, development, and evaluation stages. These lessons were then field tested on an installed TICCIT system at the Marine Corps Electronics school, Twentynine Palms, California. Based on the results of this field test, the remainder of the 180 lesson specifications were developed according to a revised procedure.

In addition to the specific instruction designed for each of the initial RCA Prerequisite Competencies (PCs), general instruction on learner strategies was planned to permeate the entire curriculum. These learner strategies are intended to encourage and support JSEP soldiers in learning and managing their study.

At the onset, a draft of the lesson specification was designed and refined, and a working version was developed. Prototype lessons were written to evaluate the entire development cycle. The knowledge gained from testing the prototypes led to the development of an approved lesson specification format.

Lesson specifications for 180 PCs were developed. A prerequisite competency was defined by RCA to mean a generic basic skill that soldiers must have in order to learn specific tasks on their skill level 1 and 2 jobs. These PCs were directly related to job task performance.

Each lesson specification was reviewed by an experienced Army non-commissioned officer and a reserve officer at FSU to increase the Army relatedness of the lesson specifications prior to being submitted to ARI. Each test item received from RCA was reviewed by experienced test developers to insure that it was consistent with the PC, as these PCs were interpreted by FSU. Indicator statements are RCA contract products which illustrate precisely how each of the PCs are used in each of the 94 MOS analyzed. It is these indicator statements that truly reflect the job relatedness of the PC and are the basis for the instruction designed to teach it.

A thorough analysis of all engineering requirements was made for the computer system being employed during the development effort. Further discussion of the equipment and maintenance requirements for the entire implementation of JSEP are contained in the Task 4 Report, The Implementation and Management Plan.

Human factors considerations for each of the prescribed systems were analyzed and are discussed in detail in that section of this report.

Use of Findings:

The entire effort of Task 5 produced two products: the lesson specifications for the 180 PCs, and useful analyses of all engineering and human factors considerations. The lesson specifications will provide the framework for the development of the short and long lessons. The information gained from the engineering and human factors considerations will aid in the development of the implementation and management plan.

JSEP: DESIGN SPECIFICATIONS

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OVERVIEW

Operational Problem

It is not news that soldiers must be trained to do their jobs. They must be trained so that each Army job is performed competently--regardless of differences in ability and background of entering soldiers. To accept less would cause many mission elements to fail.

Moreover, many Army jobs are increasingly dependent upon the soldier's ability to use high technology and the ability to learn new technology as it develops. Soldiers, therefore, need more than training. They need enough education to be able to learn subsequent jobs, to become eligible for promotion, and ultimately, to provide leadership for tomorrow's Army.

The Job Skills Education Program (JSEP) is designed to provide soldiers with job-related basic skills instruction that is prerequisite to learning their skill level 1 and 2 job tasks during their first duty assignment. Based on an extensive job analysis of the 94 most populous Military Occupational Specialties (MOS) and tasks contained in the Soldier's Manual of Common Tasks, JSEP provides functional basic skills instruction on MOS specific requirements.

As it is conceptualized, the JSEP curriculum recognizes that the vast majority of soldiers will have been exposed to similar basic skills instruction before entering the Army. Many entering soldiers, however, will not have learned those basic skills well enough, or will not remember what they learned. To help soldiers learn better and remember more, JSEP incorporates straightforward training in research-based learning strategies that are directly aimed at improving learning and retention.

Research Objective

The Solicitation required that the Florida State University (FSU):

> Adapt or adopt design specifications, including instructional specifications, engineering requirements, and human factors considerations.

To do that, we used, in part, the specified contract products from the US Army Training and Doctrine Command (TRADOC) sponsored RCA Educational Services (RCA) MOS baseline skills program. A complete list of these contract products appears in Appendix A.

This report details the activities undertaken in Task 5 of the referenced contract.

Scope

The design specifications for instruction, engineering, and human factors form a substantial portion of the bases for the activities in Phase II of the JSEP. During Phase I, FSU produced lesson specifications (for instruction) for 180 of the RCA prerequisite competencies (PCs). A prerequisite competency was defined by RCA to mean a generic basic skill that soldiers must have in order to learn specific tasks on their skill level 1 and 2 jobs.

These PCs were directly related to job performance. We estimate that these 180 PC lesson specifications are enough to develop far more than the required 420 hours of instruction. Although some PCs may require less than an hour to complete, most will take considerably more. "Apply common rules of grammar" is a good example of a lesson which will require many hours. We have developed prototype lessons on both TICCIT and PLATO which have helped refine our management system for Phase II.

Approach

The first steps following contract award were involved in planning the approach to JSEP design. Dr. Laverne Cook, the RCA Principal Investigator on the MOS Baseline Skills Analysis Project, visited an FSU-sponsored meeting of all principal project agencies to describe the RCA work. Subsequently, a team from the Army Research Institute (ARI) and FSU visited RCA for a thorough two-day briefing on the details of each of the RCA contract products. Following this meeting and considerable discussion, a plan evolved to integrate available RCA results and contract products into the JSEP design.

During the Task 1 in process review (IPR), the project schedule was revised to accommodate the delayed delivery of RCA products. While it was possible to accommodate the initial delays in receiving RCA products, subsequent delays required extensive redesign of the project. FSU began work on the lesson specifications and assigned the work for engineering and human factors to Hazeltine Corporation.

Based on the RCA Taxonomy (Appendix B), the FSU lesson specifications were developed initially on a selected sample of lessons thought to be representative of the total lesson population.

We anticipated being able to use the RCA contract products either in original or revised form to move quickly through the design stage. From RCA's descriptions of these products, we believed that they would be invaluable to our project. We had particularly not wanted to use project resources in duplicating RCA work. Unfortunately, we felt that we could wait no longer for their products and had to redirect our resources to produce lesson specifications. These resources were redirected principally from task reports that were given a revised priority.

We received approval from ARI to field test the complete lesson development process, including lesson specifications, screen displays, computer programming, test items, and tryouts in a prototype modeling mode. The topics selected for prototype development were chosen to:

1. have face validity to both military and civilian educational personnel,

2. include both verbal and quantitative elements,

3. illustrate the versatility of the computer systems,

4. represent the range of difficulty found within the RCA taxonomy, and

5. be supported by complete RCA analysis documentation.

The prototype lesson specifications were developed and the lessons programmed on both TICCIT and PLATO. Initial screen display definitions and formats were developed.

Two lessons, "Reading Gauges" and "Capital Letters," were tested on a Marine Corps Electronics School population. Hazeltine Corporation had installed a TICCIT system at the Marine Corps Electronics School, Twentynine Palms, California. The performance results of that tryout are presented in Figures 1 and 2 and are detailed in Tables 1 and 2. Notice that the highly selected Marines had no trouble at all with the lesson on capital letters--scoring very high on the pretest. However, on the gauge reading lesson, their posttest scores increased after instruction. They did not already know the content, and the lesson taught them well.

In addition to the lesson performance data that were used to revise the lessons, the additional knowledge gained in the entire prototype tryout effort was used to establish the procedures for the development of the remainder of the written lesson specifications. This revised format was approved by ARI for the remainder of the lesson specifications.

The revised procedure involved the development of draft content hierarchies. Here, a hierarchy refers to the organization of lesson content into a logical structure where each content element is considered dependent on all subordinate elements. See Figure 3 for an example of a logical hierarchy. Each candidate hierarchy was critiqued by the design review committee for consistency before the draft lesson specification was completed. Upon completion and approval of the design review committee, the lesson specification was submitted to ARI for approval.

Learner Strategies Design

In response to the requirements of the solicitation, FSU proposed a thorough review of the learning strategies literature to isolate those approaches having the most potential for practical applications. Based on our review of the literature, conferences with ARI, and recommendations from consultants, a learner strategies curriculum was designed. The rationale for this curriculum is presented in Appendix C.

A part of the learner strategies curriculum is presented in the "Introduction to JSEP," instruction designed to provide soldiers with enough familiarity on the computer system to work well. Additional learner strategies applications are found embedded within the lessons to help the soldiers recall the strategies from the introduction lesson.

Table 1

Results of the Tryout of Capitalization Lesson on the Marine Corps Electronics School Population (N=17)

	Mean	Percentage	SD	F-Ratio
Pretest	7.8	86.6	1.1	
Posttest	8.5	94.4	.94	4.07 (NSD)

Possible score = 9

Mean completion time was 35 minutes; the range was 21-49 minutes.

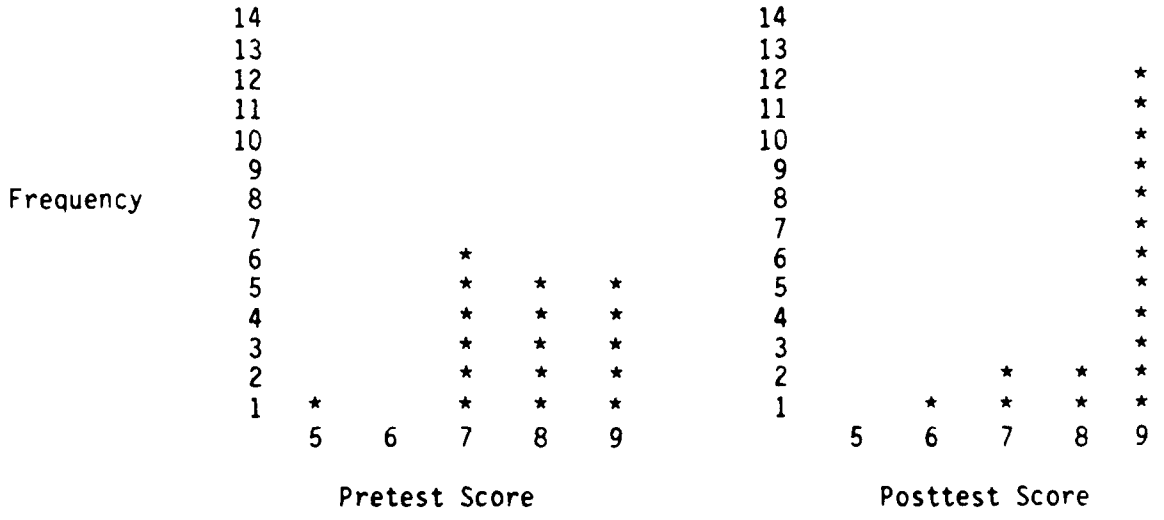

Figure 1. Frequency distribution of pre and posttest scores for a Marine Corps population on the capitlization lesson (N=17).

Table 2

Results of the Tryout of Gauge Reading Lesson on the Marine Corps Electronics School Population (N=18)

	Mean	Percentage	SD	F-Ratio
Pretest	11.5	76.6	1.72	
Posttest	14.6	97.3	.50	54.1*

Possible score = 15

*p < .01

Mean completion time was 40 minutes; the range was 31-55 minutes.

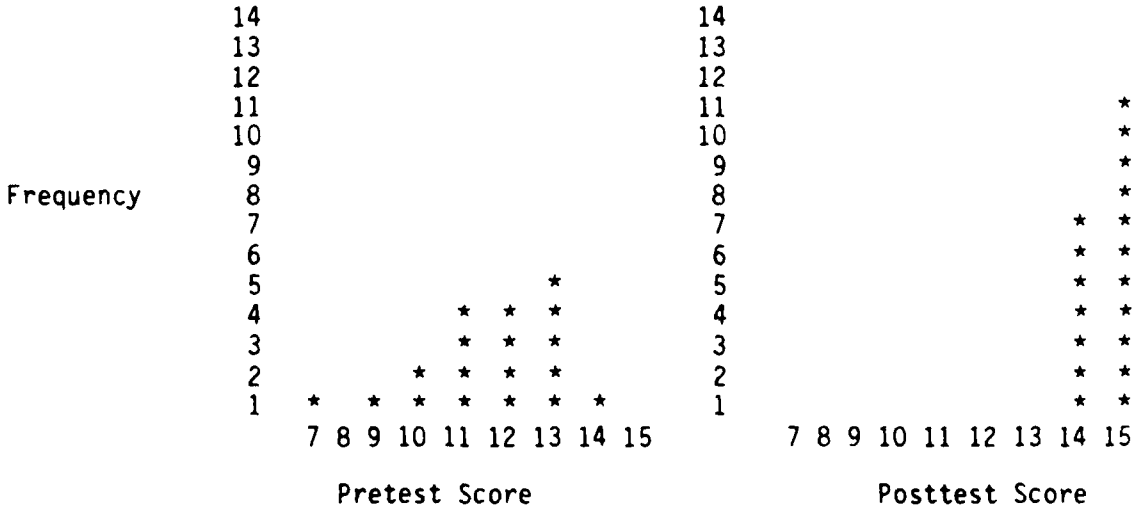

Figure 2. Frequency distribution of pre and posttest scores for a Marine Corps population on gauge reading (N=18).

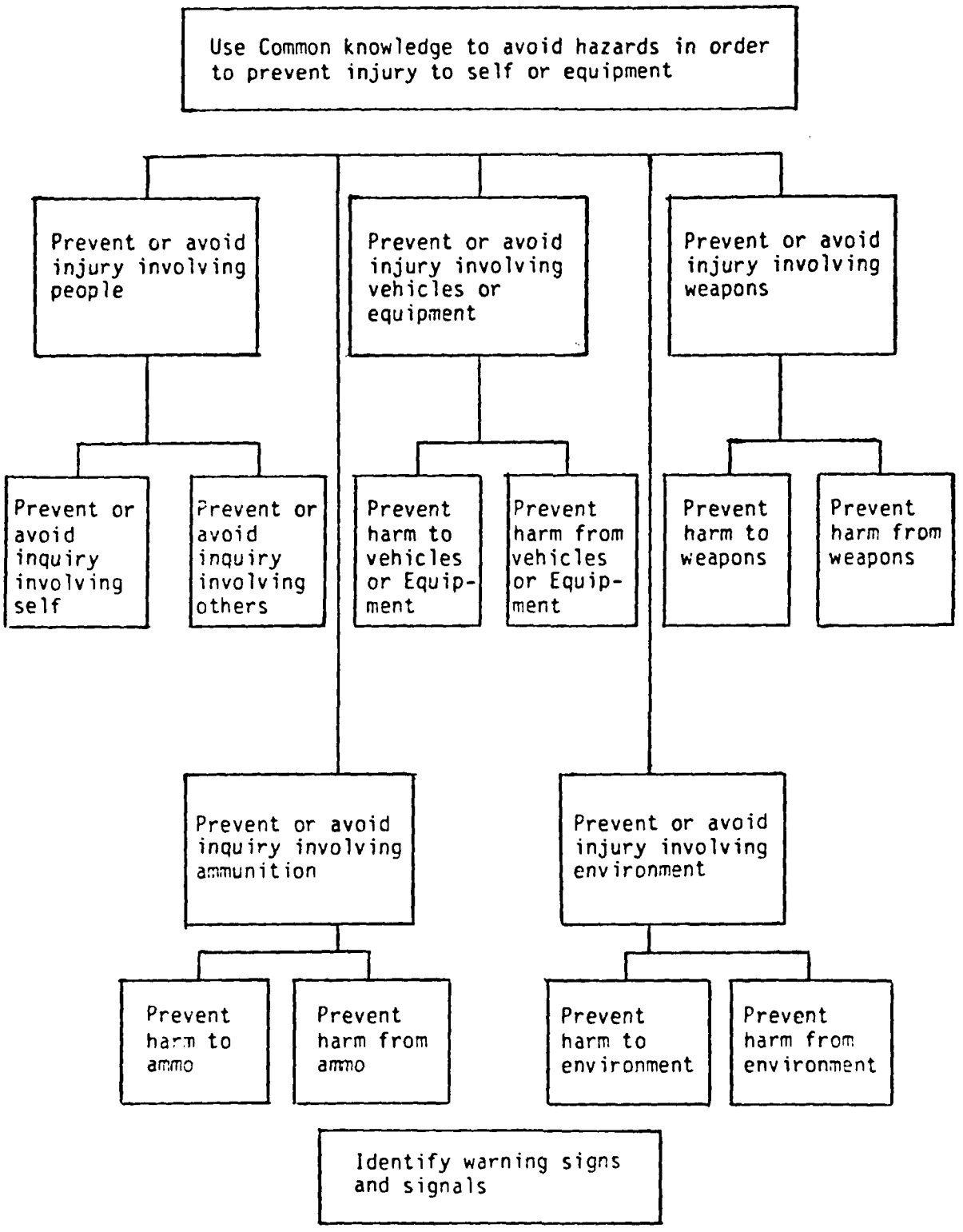

Figure 3. Example hierarchy for PC 40a "Use common knowledge to avoid hazards in order to prevent injury to self or equipment."

A team of learning strategies specialists reviewed each lesson to insure that it complied with the JSEP design specifications. They developed an animated "cast of characters," each representing a different element of the learner strategy design. These animated characters are intended to cause the soldiers to recall the strategies they should be using as they go through the lessons.

A team of Army officers and noncommissioned officers (NCOs) reviewed and modified lesson specifications to give them a more explicit Army point of view. This review team also developed a list of required Army literature that should be on hand for the instructional designers who will be doing the lessons.

Other Forms of Instruction

When we reviewed the RCA Taxonomy along with ARI sponsored reviews and evaluations of it, we concluded that the taxonomic categories were not entirely pure. While there were reasonably high correlations between analysts who examined the taxonomic categories, there were clearly some discrepancies. Further, it appeared that some of the PCs were subordinate to others. Consequently, we used the taxonomic categories more as guidance than regulation.

Our initial analysis of the taxonomy indicated that more than 90% of the PCs could use instruction provided by the chosen computer systems. Because of the logistics involved in providing other forms of instruction, it has been our design choice to look first at the computer system for instruction. If we concluded that we could neither design good instruction nor manage the instruction on the computer for certain PCs, those PCs were not included in the list of proposed lesson specifications.

If the PC required special visuals or auditory feedback not available on the selected systems, it was put into a category of instruction to be handled by education center instructors. Many of these PCs seem far more appropriate for NCO courses than for JSEP.

Lesson specifications are not planned for the following PCs found in the RCA Taxonomy:

- Category 37 "Type" (8 PCs)
- Category 38 "Characteristics" (10 PCs)
- Category 39 "Barriers" (3 PCs)

It is likely that the work being done for ARI by Dr. Barbara McCombs may be valuable for teaching these PCs.

Test Items

One of the RCA contract products was a set of test items designed to measure each of the 180 PCs chosen for inclusion in the curriculum. Since these test items were prepared for earlier versions of the taxonomy and prior to the time the analysis was complete, it was necessary for FSU to develop

additional test items that were intended to define operationally the full range of meaning of the PC as reflected in the indicator statements.

Since indicator statements described the lowest level of directly observable data, we always chose to use them rather than the more general PC statement. Obviously, this is a process of approximations; we are not likely to find a pure reality.

It is anticipated that these additional test items will not only serve as pre and posttests for the lessons, they can also be used to get a better measure of the JSEP population's prerequisite skills. Accordingly, we plan to administer the tests to samples of soldier populations when the soldiers are available.

Tracking System

Management of the planning, scheduling, tracking, and budget monitoring functions for this task was facilitated by the use of the Visi software series by VisiCorp Personal Software in conjunction with a hardware and software enhanced Apple II Plus computer.

Planning and Scheduling

Planning and scheduling was monitored through the use of Visischedule. Program Evaluation and Review Technique (PERT) charts were generated for the twenty task contract sequence and for individual tasks which required complex planning. These charts were updated monthly and action plans were generated based on the revised time lines.

Tracking

Phase I production tasks were tracked using Visidex. Each PC was tracked as to particular task development, person currently in possession of materials, and beginning date of work on task. During Phase I the PC series were tracked as lesson units. A printout of this information was generated weekly (or more often as the timelines became short), and production decisions were made based on this data.

Use of Task Five Products

The Task 5 products are used in one of three ways:

- major project plans (learner strategies, short and long lesson designs),
- the designs for future product development (lesson specifications),
- the initial draft products that will be used directly as developed (test items).

LESSON SPECIFICATIONS

One major contract requirement was that of developing lesson specifications for each of the planned lessons. These specifications will be used to design the configuration of the computer systems selected, to serve as a roadmap for the instructional designers and developers who will develop products from the plans, and serve as the source of test items for the pre- and posttests.

Two options for accomplishing this effort were presented in the solicitation. We could either adopt or modify those specifications developed by RCA, or we could develop new specifications from the available resource materials. Presented below is the rationale for our decision to develop specifications from available resources.

Review of RCA Lesson Specifications

None of the RCA lesson specifications were received by FSU until after we had developed and delivered to ARI the lesson specifications for all 180 selected PCs. To develop our independent lesson specifications, we used all RCA contract products available to us at the time the specifications were developed. The PCs were used primarily as index categories of behavior and the indicator statements were used as the primary source of the instructional requirements. The indicator statements were used in the context of the RCA task analysis.

We did receive copies of a limited number of RCA lesson specifications late in the contract period. Those we received were analyzed carefully to see how much useful information was contained in them and how they might be used in revising our lesson specifications. After studying the fourteen lesson specifications received to date, we concluded that there could possibly be some use made of them but, in general, we concur with the American Institutes for Research (AIR) conclusions about them (Hahn, 1983).

Our inferences from AIR's review of the RCA lesson specifications are:

- It is not clear how decisions were made to group the prerequisite competencies and to form the hierarchy.
- There are few specific references to military terms and situations in a program which is intended to be related to military.
- These design specifications appear to be designed for general use, rather than specifically for military use.
- As compared to learning guidelines recommended by either Interservice Procedures for Instructional Systems Development or Gagne (1975) the RCA lesson specifications include the categories

mentioned. However, the content within the categories is lacking in specific learning guidelines, sequenced learning activities keyed to objectives, and specific feedback.

RCA's design specifications were based on a new hierarchy they developed. The PCs are combined in different ways with several being covered in a lesson series. The original MOS-PC match does not appear to be a part of the new system. For example, one module groups 25c, 26a, 26d, and 41h. Some MOS require all four; others require only one or two. The match is illustrated in Table 3. The groupings appear to be made independently of individual MOS requirements.

Table 3

MOS-PC Match for Combined Module 25c, 26a, 26d, and 41h

PC		MOS 05B	05G	16P	26L	44E	55B
25c:	Follow Highly-detailed, step-by-step directions in order to accomplish a sequence of ta activities	x	x	x	x	x	x
26a:	Recognize common words and their meanings		x		x		
26d:	Recognize the meaning of common contractions, abbreviations, and acronymns	x	x	x	x	x	
41h:	Interpret codes and symbols		x	x			x

This table combines BSEP I and II requirements based on the RCA MOS-PC matrices.

We based our lesson specifications and the learning analysis on RCA's original taxonomy. The RCA taxonomy was derived from the most thorough analysis of job tasks ever done on so many MOS. Using the taxonomy and the indicator statements gives a detailed description of not only the PCs but how they are used on the job. Each MOS is described in terms of each unique set of PCs required to learn the skill level 1 and 2 tasks.

Although FSU will study the remainder of the 180+ RCA lesson specifications and incorporate the good ideas into lesson development, the problem of PC-MOS congruity precludes their use as delivered by RCA.

MEDIA SELECTION MODEL

The media selection model used in this effort was developed by Reiser, Gagne, Wager, Larsen, Hewlett, Noel, Winner, & Fagan (1981). The model provides for considering factors important to the project, particularly the characteristics of the intended learner and the nature of the instructional approach. The media selection model allows for the option of a modularized, self-paced approach to be used to teach the basic skills.

The model requires the user to consider the following:

- o instructional setting
- o scope of instruction
- o objectives of instruction
- o type of learning domain included in a lesson
- o physical capabilities (attributes) of media
- o practical factors such as cost, availability, and production time

Also included are instructional events that will be emphasized throughout the instructional program. The events of instruction include drill, practice, and motivational activities.

The media selection model operates through a series of six flowcharts, each representing a set of decisions within a general area of conditions of the training system. The charts are arranged in sequence so that decisions having the most important implications for the training are made first. Deciding which of the six charts to choose is a training systems decision.

The charts are used in progression, that is, certain media have been successively eliminated from consideration. Each chart begins with a different set of candidate media. Computer based instruction (CBI) was a viable choice for the majority of the PCs. Many would be enhanced by audio supplement and some by paper supplement. CBI includes computer managed instruction, computer assisted instruction, and computer based training. All of JSEP will be computer managed instruction and at least half of the instruction will be computer delivered.

The contract requires fifty percent or more of the instruction to be delivered by CBI. After applying the media selection model to each PC, FSU estimated that all of the 180 PCs analyzed can be at least partially learned through CBI. The medium suggested for each PC is presented in Appendix D. Having a CBI lesson for a PC does not preclude the education centers from using alternative instruction for soldiers who do not have the skills necessary to succeed on the CBI lesson or for additional remedial help. For example, JSEP is not currently being designed to teach reading to the non-reader.

Our analysis of education centers and the logistics involved in providing a wide range of media prompted us to choose CBI, except in those cases where it would be clearly inappropriate. With available resources, we believe it will be difficult for the education centers to manage a highly integrated, fine-tuned multi-media instructional system. We would like to add videodisc instruction as soon as that becomes available and practical, since that capability would accommodate audio, motion, and high resolution still visuals.

Developing Lesson Specifications

The first source of information used to write lesson specifications was the PC statements presented in the RCA Taxonomy. Some of the PCs were used as presented by RCA and some required modification to make them consistent internally and related to the inferences made from the complete list of indicator statements.

Modifications of the PCs had two results:

1. Some PCs such as 8b were more narrowly defined. "List the characteristics of geometric figures."

   The eleven 8b indicator statements included: recognizing horizontal and vertical lines, circles, the apex of an angle, a long axis, and "lengthwise".

   The instruction will *teach recognizing* geometric figures rather than listing the characteristics of them.

2. Other PCs such as 4b were broadened: "Name intervals and tell time in hours, minutes, and seconds."

   The indicator statements included another skill: use of clock positions for direction and orientation. The additional skill was added as an objective.

The lesson design approach is documented in lesson specifications (see Appendix E). An annotated lesson specification is included in the next section on lesson documentation.

LESSON DOCUMENTATION

A standard format was adopted for describing the specifications for each lesson developed. The lesson documentation serves at least two purposes. First, it serves to communicate the approved intentions to the development team that will program, produce, and implement the instruction. Second, it is a source of information for developing a curriculum index and descriptor system.

In the section which follows, each component of the specification is listed and includes a brief description of the approach to that component.

Lesson Designators

There are two kinds of lesson designators: TICCIT Designator and PLATO Designator. Both will be alphanumeric codes or names for the lessons in the computers. Lesson designators will not be assigned until Phase II of the project.

Lesson Title

The lesson title is a working title. It will be used as a "shorthand" reference to the lesson, for example, "PC 26a: Recognize common words and their meanings." The lesson title for PC 26a is "Common Words."

Prerequisite Competency (PC) Number

RCA identified each of the basic skills objectives by PC number. Each major skill category is identified by a number and title and is composed of up to ten PCs. For example, major skill category 5 is "Gauge measures", and PC 5a is "Identify the unit of measurement found on an instrument." The taxonomy is divided into either quantitative or verbal skills. Major skills 1-19 are quantitative skills while major skills 25-41 are verbal skills.

Prerequisite Competency Statement

RCA developed 201 PCs from the analysis of the 94 largest MOS in the Army. The PCs are organized into 36 general areas representing the verbal and quantitative skills associated with job related basic skills. The verbal PC areas are numbered 1 through 19, the quantitative PC areas are numbered 25 through 41. The numbers 20 through 24 were left blank to allow for expansion of the taxonomy if required. In addition to the standard quantitative and verbal skills, the PCs also describe skills related to accessing information from and using illustrations, flow charts, schematics, and forms.

As defined by RCA, PCs are those subordinate skills which soldiers must have mastered in order to learn job tasks at skill levels 1 and 2. The mix of PCs required by each soldier has been established by the job analysis in each MOS.

In the FSU lesson specifications, the PCs are the taxonomic statements that describe what the soldiers will be able to do when they complete their JSEP instruction. The specific behaviors are contained in the objectives, and the operational definition of the behaviors is presented in the test items. They are stated as generic competencies, for example, "PC 32a. Locate the block on a form to enter the appropriate information." The exact meaning of that PC can only be inferred by studying the test items used to measure it.

We plan to develop the instruction so that soldiers who complete it will be able to pass the required test items, master the required materials, and better perform their jobs.

MOS for Which Lesson Applies

We used the RCA data to identify each MOS for which the PC was applicable and included a list of these MOS on the lesson specification form.

For example, PC 36c "Identify words that need to be capitalized," is required by MOS: 13E, 55B, 71M, 72E, 91B, and 95B. The PC by MOS matrix will be used to select illustrations and examples used in the instruction and to develop test items. The matrix will also be used in the decision model that provides instructional prescriptions for each soldier.

Hierarchical Learning Task Analysis and Entry Skills

To provide a quick overview of instructional requirements in each PC and to provide as a tool that enabled the instructional designers to describe the lesson content, we used hierarchical learning task analysis diagrams to illustrate these presumed relationships. This procedure is used to identify those elements in the content that are thought to be dependent on prior learning.

The draft lesson hierarchy diagram is then used to identify what the student must already know or be able to do before learning a new skill (Gagne, 1977).

While the actual diagrams were not included in the lesson specifications as they were submitted to ARI, a list of our best estimated subordinate skills, that is, learning objectives (LOs), are found in Attachment 9 of each lesson specification. These LOs represent the skills which must be mastered or recalled for successful completion of the terminal learning objective.

Entry level skills are included in the hierarchical diagrams but are not present in Attachment 9. These skills are believed to be prerequisite to the instruction planned for any PC.

MOS Specific Indicator Statements Related to Prerequisite Competencies

In RCA's analysis, each PC has one or more indicator statements (usually hundreds). RCA derived these statements from interviews with the subject matter experts (SMEs) assigned to each of the MOS. Each indicator statement is an instance of a job related requirement to use the knowledge or skill implied in the PC. Indicator statements define the bounds of the content for the planned JSEP instruction. The fidelity of the relationship between the instruction and the indicator statement reflects the degree to which JSEP is clearly job related.

Samples of the indicator statements compiled by RCA are included in the lesson specification. Those statements are examples of how PCs are manifested in various MOS. For example, for PC 27a: "Locate a Technical Manual, Field Manual, or any related source document by code number and title." One

indicator statement for MOS 63N is "Locate the engine troubleshooting procedure in TM 9-2320-218-20, page 2-8 to 2-11."

Test Items

One of the contract products required from RCA was a diagnostic test to match the RCA Taxonomy. In addition, they were required to develop test items for the PCs. The test development effort was subcontracted to Educational Testing Service (ETS).

We used the test items obtained from ETS to get an idea of what they believed the proper content of the PC to be. Subsequently, we analyzed indicator statements from the designated MOS as our approach to validate the PC. In each lesson specification these test items have been compared to the PC, the hierarchy diagram, and the indicator statements. The items were rated as a good, fair, or poor match to the PC and indicator statements. Where we thought it necessary, we wrote additional test items to improve and clarify the operational definition of the PC.

Terminal Learning Objective and Learning Objectives

The PCs as stated in the RCA Taxonomy were used directly as the Terminal Learning Objective (TLO). We retained the PC statement to maintain consistency and communication. Some will be modified as instructional development begins. The TLO is the highest skill to be learned, as in "PC 2a: *Name the markings on a linear scale.*" The Learning Objectives (LOs) as developed through the hierarchical analysis are the subskills that must be performed in order to achieve the TLO.

The TLO and the LOs which identify the skills to be learned in that lesson are listed in the lesson specifications.

Domain(s) and Level(s) of Learning in Lesson

One of the main considerations when designing each of the PC lesson specifications is properly classifying the capabilities required in the PC and indicator statements into the proper domain(s) of learning. Five major domains have been identified by Gagne (1977) as well as the particular strategies or conditions which facilitate learning in each of these domains (Gagne & Briggs, 1979). Four of these domains are considered when developing each lesson specification. They are verbal information, intellectual skills, psychomotor skills, and attitudes.

These four domains correspond to the categories of learning described in Phase II of the Interservice Procedures for Instructional Systems Development (IPISD) (Branson, Rayner, Cox, Furman, King, & Hannum, 1976). There, these domains are called, "Information," "Mental Skills," "Physical Skills," and "Attitudes." Since the IPISD was derived from Gagne, we chose to use his terminology.

Verbal information refers to readily available knowledge in a learner's memory or the input of important verbal communication which complements the recognition of stored information and transfer of learning to a new situation.

Intellectual skills represent the bulk of learner capabilities. Discriminations, concrete concepts, defined concepts, and rules describe these capabilities in more distinctive terms.

- o Discriminations, which are considered to be a basic intellectual skill, involve distinguishing objects from each other based on sensory data.
- o Concrete concepts separate members of a particular class by characteristics (i.e., object property and object attribute).
- o Learners exhibit knowledge of defined concepts when they can classify objects, events, or relations by particular characteristics.
- o Rule learning is the composite category which includes discriminations, concrete concepts, and defined concepts. Learners have mastered a rule when their performances display a 'regularity' over a variety of specific situations. Higher-order rules involve the capability of problem solving and inventing a solution to a problem.

The psychomotor domain involves motor responses to elicit a performance. Skills are broken into part-skills (kicking legs is a part-skill of swimming) to facilitate learning of the more complex motor performance.

The fourth domain is attitude: The "persisting state that modifies the individual's choices of action" (Gagne & Briggs, 1979). The existence of the attitude is measured by the choice of a particular course of action.

Classification of each of the TLOs by domain facilitates:

1. review of the adequacy of the objectives,
2. determination of the sequencing of instruction; and
3. planning for the conditions of learning needed for successful instruction (Gagne & Briggs, 1979).

We analyzed each TLO by domain(s) to support future design and development efforts. Each of the lesson specifications identifies the domain in which the TLO falls and the domain for each of the subordinate LOs, as described in the hierarchical analysis diagram.

Outcome of Media Selection

The media selection model (Gagne, Reiser, & Larsen, 1981) was applied to each TLO. The primary guidance given to the instructional designers was to favor CBI unless the model clearly provided no means to do so. Our conclusion was that CBI is a suitable, though not necessarily optimum, instructional delivery system for more than 90% of the PCs. However, when logistics,

delivery, and courseware maintenance are considered, CBI appears to be the most generally appropriate choice.

Estimated Learner Time

Prior to lesson development and testing on the target audience, no reliable estimate of learner time can be made. However, a field trial of two prototype lessons was conducted using the TICCIT system at the US Marine Corps Electronics School, Twentynine Palms, California. Although the Marines match the JSEP target audience in age and length of military service, they differed in terms of education, ethnic mix, and classification. All the Marines were high school graduates; some had a year or two of college. The JSEP target audience is considerably less capable than Marines selected for electronics schools and most likely will need more time; however, time required remains an empirical question.

Content Summary

The summary is a brief description of suggested content. It describes the logical flow of the lesson and the objectives of the lesson, for example in PC 9a:

> Several different types of angles will be presented and differences explained. Examples and definitions including critical attributes will be followed by practice and feedback. Next, different types of triangles will be presented and compared. Then, a definition of each triangle will be presented followed by practice and feedback. Each angle and triangle will be shown in the plain geometry sense and in Army context.

Special Comments on Presentation of Skills and Knowledge

In this section, the designer communicates to the developer the specifics on prerequisites or content not covered elsewhere in the specification, and how the lesson will be presented. Also, any branching that will be done for remediation is indicated. For example, in PC 4b, the lesson specification states:

> The clock segments will be primarily on reading analog and digital clocks. The soldier may use the number keys as well as light pen or touch panel to respond. The position and direction segment could involve a game such as: A guerilla fighter (or helicopter, tank, etc.) is at your 2 o'clock position. The soldier will have to point to the position within an increasingly short period of time to avoid being "hit." The reverse can also be tried: If the soldier cannot warn a simulated other person where the enemy is, the other person will be "hit."

Common Learner Errors

Common learner error information was solicited from instructors at the TRADOC schools and from BSEP teachers. However, questions on an MOS by PC were difficult to answer. Data from the TRADOC Prerequisite Competence (PC) Criticality Review will be substituted. It is presented in Appendix F. In addition, where available, SMEs will be asked about common soldier errors on selected PCs when the long lesson is started. Other error data is being collected at the formative evaluation of the short lessons.

Indicated Revisions Based on Tryouts

Revisions will be made following formative evaluation of soldiers in the target population. Since no tryouts have been completed, no revisions have yet been indicated.

Extensive revisions are costly. It is our plan to revise when necessary during Task 16 in Phase II. We hope to wait until all lessons are done, so that we can establish a priority for doing the revisions.

Practice and Feedback Activities

The designer usually suggests only generic activities which apply to all MOS. Where an MOS or group of MOS have a specific application of the skill different from the other MOS, the designer may suggest more job-relevant instruction or practice. Examples of activities may be included, as in PC 46a:

> Practice activities will include telling time on both types of clocks. Responses can be with numbers from the keyboard and with touch panel or light pen. Error responses should branch the soldiers to remedial instruction before they continue with the practice.

Content Graphics Suggestions

The designer calls for specific graphics or types of graphics, for example in PC 4b:

> The graphics for the analog clock segment should include clock faces with standard markings with and possibly without numbers as watches occasionally do not include numbers. The graphics for the analog clock segment will be an analog clock. Both clock segments will include 12-hour and 24-hour clocks. The position and directions segments can include any of a variety of moving targets: people, planes, tanks, or helicopters.

Psychological Considerations

The concept paper by Derry and Murphy, "Strategy Training: An Incidental Learning Model for CBI" (1983), provides a thorough discussion of the rationale, empirical basis, and design objectives to be covered under this heading (see Appendix C). Understanding of the planned use of strategies (outlined in Appendix C) is critical to the interpretation of the recommendations contained in this section.

A major concern for each of the lessons designed for JSEP is the motivation of the soldier. The psychological considerations are designed to enhance this motivation and improve both learning and retention.

Each lesson specification annotates a suggested metastrategy to follow when designing the lessons. In this report, metastrategy is defined as an executive control process, a higher order organization and control of cognitive strategies. This metastrategy includes ways to establish a learning goal, ways to establish the mood, ways to monitor understanding, indications of when to memorize, and ideas for practice. The following is an example of these considerations found in each of the lesson specifications:

> Establish learning goal. In the very beginning of the lesson, the learner should be presented with a brief summary of what the lesson will cover, major points the student will be expected to learn and know, and the importance of this skill for performance on the job. Also, if possible, the learner should be given some rough approximation of the time required to cover this lesson. All learners should then be prompted to use self-pacing techniques that they have previously learned in the introductory JSEP course.
>
> Establish mood. The learners should be reminded that they have available (from the introductory JSEP course) many strategies to help them control their learning attitude and stay on-task, and that the strategies should be used in each lesson.
>
> Monitor understanding. Each segment should be clearly understood by the learner before moving on to the next segment. Learners should be told that if they need review they can request it.
>
> Memorize when necessary. Some useful memorization strategies that could be incorporated into this lesson are within-item elaboration strategies, such as elaboration and visual imagery. Another strategy that might be useful would be personalization.
>
> Practice. Practice should move from simple to complex, from same-context to varied situations.

Implications and Considerations for Delivery System Implementation

This section describes the rationale for selecting the delivery system and some features suggested. For CBI it includes a description of the role the computer will play and advantages it offers to the soldier or the management of the instruction. For example in PC 26a:

> Touch panel or light pen can be used to touch titles and code numbers on the correct document. The computer was selected for its response modes (both touch or light pen) and keyboard (numbers), graphics, and management capabilities.

DEVELOPMENT PLAN

The lesson specifications will be used to develop two kinds of lessons, short and long. The addition of short lessons for each PC is predicated upon minimizing the time required in JSEP without loss of effectiveness. Some soldiers will need only a short "refresher" on skills; for others, the same skill will be totally new or never mastered and require extended instruction and practice.

Short Lessons

The short lessons will focus on the TLO and consist of a brief introduction; a pretest (about three test items); a short review of essential rules, concepts, and operations with examples, and about three practice items with feedback. The lesson will serve as a brief refresher or review of previously learned concepts and operations so that soldiers will be able to take advantage of prior learning to reduce learning time.

Short lessons will be developed for the approximately 170 PCs considered testable by ETS. Lessons for some PCs which are not behaviorally described (such as PC 37, "Type" series) and have no criterion measures will not be developed. For example, 37a is stated "individual--a person working on a task and communicating with another when assistance is needed or when a supervisory decision is needed."

Long Lessons

The long lessons differ from the short lessons in that in the long lessons instructional objectives will include all the subskills specified in the hierarchy diagrams including the TLO. Instruction will be developed for each of the objectives, in a sequence based on the hierarchy diagram.

The long lessons will begin with a diagnostic pretest and proceed to a brief statement of the TLO. Then instruction will follow for each LO specified under the TLO. Branching directions will be available for soldiers needing instruction in other PCs. Practice items with corrective feedback and, sometimes, branches to remedial lessons and embedded tests, will be included for each objective. A posttest will be given at the end of each lesson.

A prioritizing system for long lesson development is described in the Task 3 Report for this project.

MOTIVATIONAL CONSIDERATIONS

Motivation to succeed or to complete a task is one of the more significant factors contributing to good performance. To increase the probability of positive motivation contributing to the performance of all JSEP soldiers, an introductory course consisting of "Welcome to JSEP" and "Learning Skills You Need for JSEP" was outlined. Also, a complementary training course for instructors is planned.

In Unit I, "Welcome to JSEP," soldiers will first be familiarized with the computer system they will be working with (either TICCIT or PLATO). The second lesson segment in Unit I, "Why Is JSEP Important to You," is conceived as "motivational talk" that will emphasize the job-relevance and life benefits of the JSEP curriculum. The third segment of the welcome unit, "Your Responsibility as the Learner," will introduce soldiers to the notion of self-management.

An organizing metastrategy also will be taught. The JSEP metastrategy will consist of several general steps that perscribe how soldiers are supposed to approach each basic skills lesson. The five steps in the JSEP metastrategy are:

1. Set Your Goal and Pace,
2. Control Your Mood,
3. Monitor Comprehension,
4. Memorize When Necessary, and
5. Practice Thoughtfully.

Each step in this metastrategy will be associated with a particular fictitious, animated character. Viewed together, the cast of characters should serve as mnemonic icons that will help students learn and recall the metastrategy steps. These characters will appear not only in the introductory lessons, but also throughout the entire JSEP curriculum at appropriate points during instruction.

When encountered in the basic skills lessons, the mnemonic icons could prompt the learner to recall and use strategies taught in the introductory course. The ultimate goal is to cause the soldiers to initiate spontaneously the appropriate strategy. When the soldiers perform successfully on tests, the prompts could gradually be faded out. The prompting system embedded within the MOS related lessons could also analyze student responses to find out whether or not particular strategies are being used.

In "Welcome to JSEP," soldiers will be given a brief introduction to the metastrategy and its associated cast of characters. In the forthcoming unit

of the introductory course, "Learning Skills You Need for JSEP," specific "component strategies" that can be initiated by the learner to accomplish each metastrategy step will be introduced by an appropriate character.

"Control Your Mood" promotes mood management through positive self-talk and techniques for combating mental fatigue and test anxiety. Most of the strategies taught in the goal-setting and mood-management categories will be adapted from curricular materials developed and tested by McCombs (1980) and Dansereau (1978).

The third lesson, "Monitor Comprehension," will be based on materials by Claire Weinstein and on the theoretical perspective of Ann Brown (1980). In this lesson, an appropriate character will teach self-monitoring skills that heighten awareness of and ability to deal with failure to understand. For example, the character will coach soldiers on when and how to use the review option that is programmed into each JSEP lesson.

McCombs said that the strategies that enhance students' feelings of self-efficacy and competence can, in turn, enhance self-motivation. Therefore, the method of motivation in this training model is that of teaching both metacognitive and cognitive strategies and skills that appear to underlie motivation. Examples of metacognitive strategies that underlie motivation are strategies that enhance student self-awareness and ability to assume responsibility for self-management. In the cognitive area, examples are strategies which enhance student ability to maintain attention and evaluate and choose alternatives.

The entire cast of animated characters will appear together in a final introductory lesson entitled "Making Your Skills Work Together," where the metastrategy will be reviewed as a coordinated activity. Soldiers also will be taught to modify this metastrategy to use as a technique for studying at home and for taking tests.

The Learning Strategies Course will incorporate segments of the video discs created for the HumRRo Spatial Data Management System. Specifically, the following video segments will be utilized:

- The segment on anxiety reduction and test taking strategies will be incorporated into a Test Wiseness module.
- The video segment on progressive relaxation will be used in the summary segment of the Mood Management Module.
- The video segments on "rap education" and memory strategies will be utilized in the module on Development of Skilled Memory.
- Additional video segments may be utilized for the Comprehension Monitoring module, but this module has not yet been designed.
- Assuming that the appropriate technology is available, the video segments will be interactively coordinated with instruction delivered on the computer screen.

TEST INSTRUMENTS FOR JSEP

During the contract period and for purposes of Research and Development, JSEP tests will serve six different purposes. The first test soldiers will take is the "Locator Test," one of the RCA contract products. The Locator Test screens out those soldiers who are in MOS for which they have adequate basic skills. Those soldiers who are not screened out by the Locator Test will take the second, a Diagnostic Test for their MOS. Scores on the Diagnostic Test are used to decide which JSEP lessons soldiers should take.

Each lesson in JSEP has a pretest and a posttest that are made up from items intended to measure the skills that are specifically taught in the lessons. The third and fourth types, pre- and posttests, should have enough items to permit soldiers to take them multiple times without encountering the same items. When soldiers have completed all lessons prescribed, they may be given the fifth test, a summary test, made up from items selected from the item pools of the individual lesson posttests they have already passed.

We believe that these lesson pre- and posttests may ultimately replace the diagnostic tests. When the statistical relationships among all of the tests are known, a revised testing procedure can be recommended to avoid excessive soldier testing.

When the summary test has been successfully completed, the soldiers will take a sixth test, a performance-like test, intended to predict job performance and based on actual tasks from the job. It is not planned that this test will be used during the implementation of JSEP but only during the evaluation of the JSEP materials.

Sources of Items

Items used on the lesson posttests are either selected from those already developed by ETS, modified from the ETS pool, or are constructed to match the basic skills inferred from the indicator statements from a specific MOS. We reviewed each ETS test item to insure that there was a clear match among the item, the PC, and the indicator statements in the aggregate. The number of ETS test items for each PC ranged from 6 to 26. We accepted some or all of the items for all PCs and wrote 10 new items for each PC.

In cases where we could not identify the match, test items were written based on skills derived from the indicator statements for the MOS whose competencies include that PC. In cases where stated objectives in the RCA Taxonomy match the skills derived from the indicator statements, alternate forms of the items were written using indicator statements drawn from a sample of MOS and from common tasks. All test items are being prepared for either computer or paper-and-pencil administrations.

In order to check the content validity of the individual items and of the whole test for each PC, we will ask SMEs from TRADOC to examine them. They will be given the set of objectives of each PC to determine whether the contents of the items are appropriate, whether irrelevant factors are included, whether the "mix" of items is representative with the proper weight

given to each kind of content, and whether the content is tested by measure of appropriate kinds of behavior by the examinee. The psychometric adequacy for the test items will be evaluated by an internal project committee composed of instructional design and measurement specialists.

Empirical studies of selected JSEP items will be made using a research design similar to that being employed by RCA in its validation study of the ETS test. A number of test forms will be prepared with each containing the appropriate Locator Test, the set of items for one or more PCs, and a performance-like test appropriate for the PCs.

For verbal PCs the performance-like test will be a 50 item CLOZE test constructed from a passage from the Soldiers Manual of Common Tasks or a test composed of free response items taken from some aspect of a job task that requires verbal basic skills. For mathematics PCs the performance-like test will be made up of free response items that closely parallel the multiple-choice ones. The free response tests are a part of the formative evaluation process only and will not be included in the implementation phase, thus they will not be computer administered.

Another performance like test will be based on RCA's research. RCA is currently validating the ETS tests on a large population of soldiers. RCA has reformatted the diagnostic test items to measure whether soldiers are able to apply their JSEP knowledge in a simulated job situation. They have created a job scenario for the test items, then have asked the soldiers to make a free response. Although RCA reads the test to the soldier, this same type of performance like test might be administered on a videodisc or in print.

Each test form will be administered to soldiers in education centers. The results will be used to establish item difficulty and discrimination indices as well as aid in item revision and calculating test internal consistency reliability. Relationships between PC and Locator tests will be calculated and used in combination with ETS and RCA results to predict which soldiers need to take the short lessons of the PCs. Performance-like items and tests will be used to help establish or validate criterion cutting scores. The performance-like items will be developed for common task PCs. If the results of formative evaluation indicate need for it and time and resources required print supplement, some performance-like test items could become a part of the implementation phase of JSEP.

ENGINEERING SPECIFICATIONS: HARDWARE REQUIREMENTS

Computing Systems

All supplied computer systems shall be consistent with the solicitation; however, those systems used in courseware development may contain features or processing capacity not present in delivery systems. It shall be possible to configure delivery systems to allow editing of courseware for the purpose of making corrections and interim field updates. All systems shall provide automatic entry to an operating system. Delivery systems shall provide entry into the JSEP sub-system which is automatic and transparent to the user.

Courseware Development System(s)

The courseware development system shall contain sufficient capability to support all required courseware development functions, system load requirements, and the instructional management system requirements.

Delivery System

The student courseware delivery system shall contain sufficient capability to support all required student delivery functions, limited courseware editing as described by the courseware development system, the system load requirements, and the instructional management information storage requirements. Restart/recovery shall also be provided.

Powerfail/Restart and Line Surge

The system shall possess sufficient ability to deal with catastrophic events (power failure, communication failure, etc.) that significant student data shall not be destroyed.

Mass Storage

All permanent mass storage provided shall be capable of expansion. It shall be possible to expand the total amount of storage by at least one hundred percent.

Courseware Development System(s) (CDS)

Sufficient courseware development system disk storage shall be provided to contain all required CDS operating system software, system generation software, utility software, source information for all courseware, and object courseware.

Delivery System

Sufficient delivery system disk storage shall be provided to contain all required operating system software to support courseware delivery.

Data Transportation Between Sites and Backup

A compatible means of transporting data between sites and a means of backing up disk data to removable media shall be provided.

Delivery Systems

Delivery systems should have the capability to load materials sent from the courseware development system. Additionally, delivery sites should have the capability to dump information files to removable media loadable on the courseware development system to allow shipment of management data to the courseware development system for interpretation and data reduction. This same removable media shall be utilized for backing up critical system information such as student records and maintaining a current backup of all system information.

Printer

Courseware Development System(s)

A printer capable of producing hard copy of American Standard Code for Information Interchange (ASCII) text files and graphics shall be provided as part of the Courseware Development System.

The printer shall provide the capability of reproducing (without color) all special characters, graphics, and overstrikes.

Delivery Systems

Minimum capability for each system. Delivery systems require a printer capable of producing hard copy of ASCII text only. The printer(s) shall be capable of producing 80 characters per line using all of the 94 printable ASCII characters.

Expanded capability for selected systems. The system shall be capable of supporting a graphics printout capability to reproduce stored text/graphics/forms which have been entered into the system. This capability is required to make facsimiles of offline instructional materials available to students.

Student/Courseware Development Terminal

The student and courseware development terminal shall consist of a local refresh processor, contour keyboard, and video display with the characteristics described herein.

Character Set

The terminal shall provide for the display and generation of the 94 printable ASCII characters. The system shall allow definition of additional characters, symbols, or functions on the standard keyboard for use in special subjects for which the system will be used.

Display, Light Pen, and Touch Panel

The display memory shall be refreshed at a frequency sufficient to maintain character intensity over the entire display. A light pen or touch panel interface to the display controller shall provide minimum capability of 4 characters by line 2 resolution anywhere on the CRT screen. The display shall be capable of presenting a minimum of 16 lines of text, with at least 40 characters per line. The display shall be capable of presenting both textual and graphic information on the same frame. The display hardware shall be capable of clearing the entire screen in 1/60th of a second or less.

Keyboard

The keyboard shall be a full size "typewriter" style, QWERTY or DVORAK arrangement and will contain keys associated with a majority of the 96 ASCII text characters. It will also include any special function keys needed for courseware delivery or for courseware development keys. An auxiliary 10 key pad may be provided which may duplicate, but not replace, the numeric characters of the ASCII set of the QWERTY keyboard.

ENGINEERING SPECIFICATIONS: SOFTWARE REQUIREMENTS

Operating System

Basic Characteristics

An efficient operating system capable of supporting the total system load described under "System Load" shall be provided. System functions may be split among multiple processors provided that the system as a whole satisfies all listed requirements.

File System

The operating system shall include a complete file system for use by application programs. The file system shall allocate mass storage space on demand and maintain the necessary file directory, to include the filename, size, and date and time of last access. The file system shall be able to create, delete, rename, read from, and write to files. Application programs shall be able to read and write all courseware files. It shall be possible for student information files to be opened for either exclusive or shared use.

Protection (Mapping)

The operating system and basic computer architecture shall prevent any user program from overwriting operating system memory or the memory reserved for any other user.

System Load

Each delivery system shall be capable of supporting an assigned number of student terminals. Average response time (that is, the time from when a student completes an input until the system has begun displaying its response) for a fully loaded system shall be less than .25 seconds. This assumes that each student will receive a new display every 20 seconds on the average, that each display will average 500 characters, that each student input will average 20 characters, and that 20% of all displays will contain a graphic.

Security

The system shall maintain at least eight (8) inherent categories of security, five (5) of which shall be as described herein.

Student level. A student shall be able to access only courseware for which he or she is registered and shall follow an assigned path in proceeding through that courseware. A student shall not have access to other students' data.

Instructor level. Any instructor shall be able to access the courseware without any sequencing constraints and may be given access to selected system utilities.

Courseware developer level. A courseware developer shall be able to access source courseware and perform and define object courseware without sequencing constraints. Where appropriate, the courseware developer shall be able to modify and debug existing courseware and produce new courseware.

Operator level. The system operator shall have access to all system functions necessary for the daily operation of the system.

System programmer level. Persons designated as system programmers shall have access to all system functions.

Courseware Development System

The courseware development system shall consist of a course development language or languages, together with text editors, compilers, interpreters, and utilities required to implement the language(s). All of these features shall be available to courseware developers at any terminal connected to the courseware development system(s). A limited number of these features may be available on the delivery systems. The courseware development system shall be able to support at least drill and practice, concept and rule learning, and simulations.

Data Features

Arithmetic operators and functions. The languages supplied shall include the arithmetic operations of addition, subtraction, multiplication, division, and exponentiation, and perform the mathematical functions sine, cosine, tangent, arctangent, logarithm, natural logarithm, and exponential. Nested parenthesis shall be allowed. The relational operators may be supported, along with the boolean operators. Automatic type conversion shall be performed. (For example, a real number will be rounded off if it is put into an integer value and vice versa.)

Symbols. The language shall allow the courseware developer to define new symbols with alphanumeric names. Symbol types shall include variables and constants (literals). Variables shall include scalars, vectors, and matrix arrays.

Data types. The language shall include at least the following data types for user defined variables and literals:

1. Integers
2. Reals
3. Alpha Numeric Strings
4. Logical (Booleans) Truth Values

Display Construction

It shall be possible to construct displays of the desired characters exactly as they will be seen by the student. The courseware developer shall be able to use courseware development system utilities to assist in constructing the desired display.

Response Analysis

Response analysis consists of the comparison or "matching" of the student inputs against courseware developer specified responses. Requirements for this matching process are described herein.

Response types. The system shall include the capability to support each of the following types of questions.

- o Yes - No.
  If the first non-blank character of the student input is "y" or "Y", a positive response is tallied, if it is "n" or "N", a negative response is tallied. Any other characters will be ignored.

- o Multiple Choice.
  Each non-blank character is considered a separate input. Capitals and lower case inputs are equivalent. Punctuation shall be ignored. Only offered choices will be processed. Any other characters will be ignored.

- o Short answer (text).
  Matching shall be on the basis of words and punctuation. All of the pattern matching techniques shall apply. Automatic detection of misspelling shall be provided.

- o Numeric Values.
  Matching shall be on the basis of numeric values. Equivalent values shall be recognized automatically. For example, inputs of "2", "+2", "1+1", and "2 sin 90" shall all be considered equivalent.

- o Edited text.
  The courseware developer shall be able to display to the student a block of text which the student may then modify The matching shall then be on the basis of the block of text as specified by the courseware developer and subsequently modified by the student.

- o Pointing.
  Matching shall be on the basis of the screen location touched by the student with the light pen or touch panel. A correct match is one which falls within a rectangular screen area specified by the courseware developer. In textual responses it shall be possible for the courseware developer to detect which word in a sentence or paragraph was marked with the light pen or touch panel and perform response analysis on that word.

Pattern matching. The pattern matching features described herein shall be included.

- o Order.
  The courseware developer shall be able to specify that the student input words shall be in a particular order, or may allow them to be in any order.

- o Capitalization.
  The courseware developer shall be able to require correct capitalization, or ignore capitalization differences.

- o Misspelling.
  The courseware developer shall be able to require that student inputs be correctly spelled, or that spelling errors are to be ignored. The spelling alogrithm provided shall be 95% accurate for words of five or more letters.

- o Pattern specification.
  The courseware developer shall be able to specify key words and phrases, and indicate the positions in which any keyword or phrase may be found. A match shall then occur regardless of what words, if any, lie between the required key words. Following such a match, the courseware developer shall be able to examine, by themselves, those words which separated the key words in order to perform further pattern analysis.

- o Normalization.
  The courseware developer shall be able to specify that all punctuation marks be ignored in matching, or that specified words or symbols be ignored.

Feedback. The courseware developer shall be able to identify, and report with different feedbacks to the student, various anticipated correct or incorrect responses to any question. The courseware developer shall be able to format and display the feedbacks in any way desired and may include graphics. The courseware developer shall also be able to highlight specific portions of the student input at the time the feedback is given.

Built-in Features

The courseware development system shall include built-in procedures to simplify the courseware development task. These procedures shall be an integral part of the courseware development language(s) supplied. The built-in features shall include at least those described herein.

Automated scoring. The system shall be able to keep score automatically based only on the courseware developer indication of whether the student correctly answered each question.

Item sequencing. The system must include provisions for selecting items (questions) for presentation to the student from a bank of possible questions, according to a courseware developer selected pattern. The available presentation patterns shall include at least:

- o Random without replacement.
  Present items in a random order beginning from a random point. Do not repeat any item until all items have been presented. Then

present only items previously incorrect before using those correct on the previous try.

- o Random with replacement.
  Present the items in a random order beginning at a random point without regard to whether or not they have already been presented.

- o Sequential.
  Present the items sequentially in the order created by the courseware developer.

Default answer processing. A built-in response analysis procedure shall be available to handle simple response analysis needs. The courseware developer shall identify the response type and the correct answer. The system shall then determine the correctness of the response and supply appropriate feedback. The courseware developer shall be permitted to supply any unique feedback in lieu of the system supplied feedback, if desired.

Function keys. Pre-definition of common function keys may be supported. In particular, the system shall process keys provided to back-up to the preceding display, to quit the current lesson, to repeat the current display as it was prior to any input and to solicit assistance where such is appropriate.

Program Development Aids

The program development aids described herein shall be included as a minimum.

Source listings. The courseware developers shall be able to obtain printed listings of all or any desired portion of a courseware source file in a format similar to that shown on the display during editing. The listing shall include all courseware developer supplied data.

Cross reference listings. The courseware developer shall be able to obtain a printed listing of the symbols he or she has defined.

Shared materials. The courseware developer shall be able to incorporate any lesson developed into multiple courses without having to duplicate the source or object materials involved.

Debugging tools. The courseware developer shall have at least the facilities described herein available while debugging the compiled object courseware.

- o Symbolic Debugger.
  A symbolic debugger which provides for the display of the current value of any developer defined variable. Further, the developer shall be allowed to modify the displayed value.

- o Breakpointing.
  The courseware developer shall be able to interrupt courseware execution on any command in the courseware in order to use the symbolic debugger described. It must be possible to insert or remove these breakpoints without substantial change to the source materials.

Compilation

The courseware development language compiler supplied shall conform to the requirements stated herein.

Error reporting. The compiler shall produce error reports for all errors detectable during compilation. These error reports shall describe in English words the nature of the error and shall identify the command in which the error occurred. Where applicable the specific syntactic element in error shall also be reported.

Partial compilation. Compilation of any single display shall be allowed in order to save compilation time when corrections are made to one of several displays in a lesson. Compilation of the entire source file shall also be supported.

Subroutines and Macros

It shall be possible for the courseware developer to incorporate subroutines in source files to permit sharing of common routines among courseware developers and files. Returns from subroutine execution shall be to the next sequential command after the subroutine call.

Graphics Production

All of the features described herein shall be available for use in the production of graphics for incorporation into any courseware display. It shall be possible to use these features separately or in combination to produce a complete graphic.

Drawing. The courseware development system(s) shall provide a method for inputting and storing line drawings. The input method(s) may include digitizing camera, graphics tablet, or software graphics editor. The storage format(s) for the resultant data may include the digitized or linear encoded formats.

Plotting. It may be possible to create a graphic or portion of a graphic by inputting a mathematical equation The system may plot the input formula on the display. The equation to be plotted shall use addition, subtraction, multiplication, division, exponentiation, nested parenthesis, and the functions sine, cosine, tangent, arctangent, log, and natural log.

Character sets. The courseware developer shall be able to define and use special character sets in constructing graphics. These character sets shall allow the redefinition of certain keys on the keyboard. Additional character sets defined in this fashion shall allow each character to be displayed as pattern of dots within a rectangular character space.

Graphic Families

The courseware developer may also be able to define and use graphic families. Graphic families shall provide for the storage of a graphic of any size up to full display screen linked to certain of the keys on the keyboard. The courseware developer shall be able to invoke a named family and pressing the keys associated with the various graphics, add graphics to the display. This feature may allow the rapid construction of graphics from various common components by simply typing in the components.

Expand-shrink-rotate. The courseware developer shall be able to expand or shrink the size of a graphic. Developers shall also be able to rotate the graphic by specifying the amount of rotation desired.

Courseware Delivery System

The courseware delivery system shall support all of the features that can be developed using the courseware development system.

Instructional Management System

The instructional management system shall be fully integrated with the courseware development and delivery system. A unified set of reports and status displays shall facilitate inclusion of all parts of the curriculum whether taught using the delivery system components or as off-line components of a course presented via some other media.

Student Sequencing

The system shall sequence the student through all required course objectives, according to criteria established by the course developers. Access to each lesson require prior completion of all prerequisite lessons. System supplied advice shall be given to students when they attempt to enter materials other than those for which their progress authorizes them. Students shall be informed of the options available to them upon request via the delivery system input means provided for that purpose.

Student Scoring

The result of all tests shall be incorporated into the student's permanent record and used to determine the future sequence of the student through the course. For off-line tests or lessons, a method shall be provided for incorporating the resulting scores in the student's permanent record.

Instructor or Proctor Reports

The system shall provide display and printed reports on request for use by the learning center instructor or proctor. These reports shall provide details of the status of each student in a class (section), including lessons taken, number of test attempts for each lesson, and time spent in each lesson. Class averages shall be provided for comparison purposes. The report shall be sorted, as specified at the time it is requested in order either alphabetically by student last name, by number of lessons completed, or by time spent on-line. Similar reports shall be available on request on the terminal screen for those users authorized access to them.

Item Analysis

The system shall provide for the collection and reporting of data relative to the performance of test items (questions). Reports of item performance shall be available for all of the items relative to each objective (segment) for which items exist. The reports shall differentiate between item performance for those students who passed and those who failed the test which included the item. Reports shall contain the number of students attempting the question, the percent answering correctly, the percent of anticipated incorrect responses, the percent of unanticipated responses, and the average response latency.

Notes

The system shall be capable of providing a report for the courseware developers containing any notes or comments made by students during the course. Each note reported shall contain student identification at the time the note was made. This location information is to be automatically attached to the note by the system.

Monitoring

Authorized users such as instructor or proctors or courseware developers shall be able to see the same displays on his or her terminal as are appearing on a student terminal selected for monitoring. The soldiers can receive messages that they are being monitored.

Manual Scoring

A function shall be available during courseware execution which allows the instructor or proctor to enter grades from off-line materials. This function shall be protected, allowing only authorized personnel to access the function.

Utility Software

Registration

A software package for use in registration of students and other users of the system shall be provided. Information required for registration of users shall include name and password. It shall be possible to delete registration records, thereby dropping the user from a course. The registration function shall provide for modification of a registered user's name or password, without changing the current course progress data for that user. Access to the registration process shall be controlled by the system.

Communications

Inter-terminal communications. The system shall provide a facility for a user at one terminal to initiate an on screen dialogue with a user at another terminal. The user being called shall have a choice of answering or rejecting the call. Either user involved in a call shall be able to terminate the call. The user being called shall be informed by the system as to who is calling.

User mailbox. The system shall have a "mailbox" facility. Any user authorized access to the mailbox facility shall be able to leave a message for one or more other users. The writer shall be able to specify the recipient by name. Messages of multiple pages shall be possible. It shall be possible to move the contents of a message page onto a courseware page for inclusion in a lesson. Users with new mail in their mailbox shall be notified whenever they log on to the system.

Text Editor

A text editor shall be provided which has the capability to display and provide for the modification of program source files by authorized users. The text editor facilitates the addition, deletion, insertion, and replacement of single characters, strings or characters, and complete lines. The text editor shall have an "inspect" mode wherein text files may be looked at without possibility or danger of modification.

Additional Devices

The management system will provide for integrating lessons developed for the Handheld Tutor and for the Spatial Data Management System (SDMS). .pa

HUMAN FACTORS

Human factors considerations have been primary concerns in developing a complete CBI system specification. Since JSEP must be a complete system, it is necessary to address human factors in hardware design and configuration, system software, and in the training for all system users. In considering the human factors that apply to the JSEP system, we have carefully reviewed the pertinent research. Much of the research that we have reviewed has come from the study of the development of expert knowledge and the study of the design of procedural instructions (text and graphic) for operation and maintenance of complex systems.

Hardware

Usability

The system specification calls for off-the-shelf components and software comparable to already installed CBI systems. Such systems are in everyday use at Army, Navy, Marine, and Air Force installations; they have proved to be easy to use.

Readability and Glare

The alphanumeric display characteristics of the display must be easily read. The character matrix must provide crisp character definition as well as allowing enhancements through use of partial or full color where available, blink, and the like. A display screen must minimize glare from overhead lighting. The keyboard allows the user to vary his or her position relative to the display and surrounding environment so as to minimize extraneous visual distractions and achieve optimal readability. A display should be refreshed at a 60 field per second frame rate, eliminating all perceptible screen flicker.

Display

In addition to the properties discussed above, the brightness and contrast of the display stations must be adjustable.

Correction Capability

In the courseware delivery mode, the student must have complete control over the input before it is transmitted. He or she must be able to delete any text input one character at a time, replace any character with another, or delete blocks of text. The student, by pressing a designated key, must be able to repeat any display (with accompanying audio, if audio is used).

Durability

The standard off-the-shelf hardware used in the CBI system must be built to commercial standards and subjected to government approved commercial Quality Assurance procedures of the manufacturer.

Audio Quality

The audio system if used must provide rapid access to high quality audio. Terminals equipped with the audio option must be able to access this data to provide audio accompaniment to visual presentations, prompt student interactions with voice messages, and provide audio supplements to visual feedback messages. The recording system must support easy creation of the messages, and result in audio that is reasonably natural sounding and intelligible.

Instructional Managerial System

Computer Managed Instruction

Computer Managed Instruction (CMI) must take into account several human factor concerns when dealing with students and instructors. The diagnostic testing must provide an automated assignment to each student indicating the sequence of learning tasks to be completed. These prescriptions can include remedial materials and follow-on subjects both for on-line materials and for materials taught by other media. The student's instructor must have the ability to make assignments where desired rather than their being made automatically by the CBI system.

The system should provide the student with information concerning appropriate learner strategy options. Specific learning prescriptions should be formulated on the basis of test results, instructor inputs, or combinations of all these. This feature will permit students to follow an optimum path through the training materials but at the same time ensure that they have demonstrated mastery of all required training objectives.

The performance data should be used to produce a number of standard reports as part of the Instructional Management System. The reporting programs should build and use a variety of summary files which are then used to display or print desired reports for instructors and course administrators. The summary files themselves constitute an additional database which may be used to assist in improvement of the lesson materials.

Reports of student progress information should be selectable for individual students, a group of students, or an entire class. The information reported shall include such items as: student name; student ID number; the total amount of time spent by the student on each lesson and the average time spent by all using students; the number of times the student attempted the lesson test and the average for test attempts; and the student's score for the lesson.

In addition to the student performance data, the system shall also collect data to assist courseware developers. An item analysis feature should be available to help courseware developers and instructors examine student responses to any test item and analyze those responses to identify potential problem areas in the course materials.

To assist the site manager, the Instructional Management System should collect data on system utilization. Such information permits timely allocation of instructional resources to optimize system effectiveness during peak hours of operation.

Training in System Use

A major human factors concern with any system is that the people who must work with the system should be adequately prepared to use it. To that end the CBI system must be supported by training designed to meet the needs of all system users.

Author Training

The authoring system must not only be easy to use, it must also be easy to learn. Along with guiding the author through the authoring process, the authoring system must provide complete training which describes the basic aspects of the authoring system.

This integrated training should provide authors with an efficient way to learn, and at the same time, to apply the learning to the production of course materials.

Courseware Design

Experienced courseware designers need to be trained to apply instructional design principles to the specific capabilities and features of CBI systems. We expect this to be the case with the JSEP system. The system selected for JSEP, therefore, should support such training.

Maintenance Course

In order to provide for all required maintenance of the JSEP system, a course in JSEP maintenance should be provided. This course should at a minimum, provide guidance to users concerning how to maintain their systems and include instructions concerning how to get any additional assistance they may require.

Instructor Training Course

Since many JSEP instructors will never have had experience with CBI prior to JSEP, it is essential that a course designed for instructors be provided with the JSEP system. Such a course must at the very least explain how CBI

system features can enhance the instructor's ability to monitor soldier performance during instruction and how available on-line and off-line reports can be used to help the instructor improve student performance.

Student Course

Soldiers new to CBI will need to become acquainted with the operation of the CBI system from their own perspective. An on-line course shall be provided designed to teach new soldiers how to use appropriate system features to help learn more effectively. Usually students become comfortable and proficient using the system in less than an hour.

HAND-HELD COMPUTERIZED TUTOR

A viable option for testing and drill and practice is the Hand-held Tutor developed under contract to ARI. A prototype Hand-held Tutor was demonstrated at FSU. FSU received a model lesson and will receive program specifications. Table 4 lists candidate lessons for use with the Tutor. The table describes to what degree the Tutor can be applied and what supplementary materials, if any, are needed. It should be understood that this initial review only surveys the possibilities of the Hand-held Tutor. Also, these categories could change as the development of lessons uncover either possible options of the Tutor not now visualized or constraints such as cost or capability limitations. FSU will produce prototype lessons for the Hand-held Tutor for empirical tryouts.

Table 4

Candidate Hand-held Computerized Tutor Lesson Supplements

*Prerequisite Competency (PC)	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
NUMBERING AND COUNTING						
1a. Match numerals with word names and models			x		x	Provide practice using audio and keyboard
1b. Write numerals one through "N" in sequential order from any starting point			x		x	Provide practice using audio and keyboard
1c. State what numeral comes after, before, or between any two given numerals			x		x	Provide practice using audio and keyboard
1d. Select the numeral which is greater/lesser from a set of numerals			x		x	Provide practice using audio and keyboard
1e. Identify an object with a specified ordinal position			x	x		Can also use audio and keyboard to distinguish 1st, 2nd, 3rd, etc.
1f. Write or state the place value of a particular digit, whole, for decimal number			x	x		Some portion could be done without book
1g. Round off a number to a specified place, whole, or decimal		x		x		Some portion could be done without book
1h. Count by ones, twos, fives, tens, etc. backward or forward (skip counting)		x			x	Provide practice using audio and keyboard
1i Match numbers with points or intervals on a number line (positive (+) or negative (-) values)	x					

* The PC numbers come from RCA Taxonomy

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
LINEAR, WEIGHT, AND VOLUME MEASURES						
2a. Name the markings on a linear scale			x	x		
2b. Differentiate units of measure and equivalents in the English and metric system			x	x		
2c. Use a ruler, yardstick, meter stick, or scale to measure lengths of objects or distances			x	x		Would also need the measuring instruments to supplement
2d. Identify measures of ounce, pound, gram			x	x		
2e. Identify measures of pints, quarts, gallons, liters			x	x		
2f. Use a scale which is not numerically calibrated	x					
2g. Estimate measures of varying lengths, dimensions, or weights			x	x		
DEGREE MEASURES						
3a. Identify degree or mil as a unit in determining direction, distance, or temperature	x					
3b. Estimate the measure of a given angle not greater than 180 degrees	x					
3c. Interpret bearings azimuth and other contexts in which the measure of an angle may range from 0 degrees to 360 degrees/0 to 6400 units	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
TIME-TELLING MEASURES						
4a. Use a 24-hour or digital clock to tell time			x	x		
4b. Name intervals and tell time in hours, minutes, and seconds	x					
4c. Estimate time in seconds, minutes, and parts of an hour	x					
4d. Identify calendar units and arrange them in Julian style	x					
4e. Convert time into hours and tenths of hours			x		x	Provide practice converting time displayed on screen or
4f. Compute time using Greenwich Mean Time (GMT) as a basis for establishing zones and distances	x					
GAGE MEASURES						
5a. Identify the unit of measurement found on an instrument			x	x		Too many instruments. May have possibilities for some MOS.
5b. Interpret the number, word, symbol from a display read-out			x	x		Some simulations of responses to read-outs could be developed using screen, audio, and keyboard.
5c. Recognize a "reading" from a gage with color divisions	x					
5d. Recognize positive (+) and negative (-) demarcation on a scale	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
5e. Select band(s) from a multi-scale gage	x					
5f. Match a gage reading to a specification using numbered or labeled intervals			x	x		
5g. Interpret gage readings from an unnumbered/ unmarked interval	x					
5h. Interpret a gage reading which is fluctuating or momentarily sustained	x					
5i. Match specifications of required measures by manipulation, alignment, or maintenance	x					
SPATIAL						
6a. Identify directions that tools, hardware, or components may be moved			x	x		Use illustrations to show directions
6b. Manipulate objects to align, match, mate, make parallel, be perpendicular, or be at an angle	x					Calls for learner to manipulate parts
6c. Interpret spatial relationships of figures and objects from 2-dimensional drawings, pictures, or photographs	x					
6d. Relate geometric aymbols and graphic representations to actual systems, subsystems, and components	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
LINES						
7a. Identify and name points, lines, rays, and segments			x	x		
7b. Identify intersecting lines, parallel lines, and line segments	x					
7c. Define and identify perpendicular lines	x					
7d. Identify congruent segments	x					
PLANES						
8a. Identify and name plane geometric figures			x	x		
8b. List the characteristics of geometric figures			x	x		
8c. Classify figures according to the number or measure of its sides or angles			x	x		
8d. Identify figures which possess similarities			x	x		
8e. Identify figures which may be parallel, perpendicular, or congruent			x	x		
ANGLES AND TRIANGLES						
9a. Identify and name the different kinds of angles and triangles, with their corresponding figures			x	x		Problems require diagrams
9b. Identify vertical, adjacent, complementary, or supplementary angles			x	x		Problems require diagrams
9c. Classify triangles according to their sides or angle-size			x	x		Problems require diagrams

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
9d. Identify altitudes and medians of triangles or the biaector of an angle			x	x		Problems require diagrams
9e. Name an angle by using letters, a number, or a single letter			x	x		Problems require diagrams
SOLIDS						
10a. Recognize and match the names of solids with their corresponding figures			x	x		Problems require diagrams
TERMINOLOGY						
11a. Identify technical words associated with geometric figures			x	x		
11b. Interpret meaning of terms derived from spatial orientation			x	x		
ADDITION AND SUBTRACTION						
12a. Add or subtract whole numbers, without carrying, or borrowing		x			x	These problems may need scratch paper for figuring
12b. Add or subtract whole numbers, carrying, and borrowing		x		x		These problems may need scratch paper for figuring
12c. Add and subtract, borrowing and carrying, with mixed numbers (whole and decimals)		x		x		These problems may need scratch paper for figuring
12d. Add or subtract positive (+) and negative (-) numbers, using a number line to arrive at a solution	x					
12e. Add or subtract to find correct time (24 hr. clock) using hours or minutes			x	x		These problems may need scratch paper for figuring

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
12f. Add or subtract various increments on gages, dials, or any other measuring instrument			x	x		These problems may need scratch paper for figuring
12g. Add or subtract time, linear, dry, liquid, or degree measures requiring regrouping			x	x		These problems may need scratch paper for figuring
12h. Estimate a sum or difference			x	x		These problems may need scratch paper for figuring
MULTIPLICATION AND DIVISION						
13a. Multiply and divide whole numbers			x	x		May require scratch paper for figuring
13b. Multiply and divide mixed numbers (whole and decimals)		x			x	May require scratch paper for figuring
13c. Divide a number with decimals in both divisor and dividend		x			x	May require scratch paper for figuring
13d. Multiply and divide integers, both positive (+) and negative (-), and assign proper sign to product or quotient		x			x	May require scratch paper for figuring
13e. Estimate a product or quotient			x	x		
FRACTIONS/DECIMALS						
14a. Subdivide whole objects or a set of objects into halves (1/2), thirds (1/3), fourths (1/4), eighths (1/8)			x	x		Some illustrations such as charts or gages must accompany problems
14b. Reduce fractions to lowest terms	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
14c. Convert fractions (proper and improper) to decimal equivalents, and vice versa, using a table, chart, or gage	x					
14d. Compute equivalent value of fractions, decimals, percents, and mixed numbers to lowest terms	x					
14e. Add and subtract fractions, with same or different denominators	x					
14f. Multiply and divide fractions with and without whole numbers	x					
14g. Estimate a fractional sum, product, or quotient	x					
GEOMETRY						
15a. Draw geometric figures, plane, and solid	x					
15b. Match geometric figures with word names, equivalent measures			x	x		
15c. Label all parts of geometric figures using mathematical and characteristic designators	x					
15d. Use a protractor to measure angles, make geometrical constructions	x					
15e. Construct perpendicular on a line segment, bisector of an angle	x					Asks learner to construct angles
15f. Compute the perimeter and area of any figure	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
15g. Compute the circumference and area of a circle			x	x		May need scratch paper for figuring
15h. Compute the area and volume of any solid circle figure			x	x		May need scratch paper for figuring
15i. Use formulas in solving problems involving circle geometric figures			x	x		May need scratch paper for figuring
15j. Solve problems and interpret spatial relationships of figures, symbols, and objects from 2-dimensional displays	x					
COMBINATION OF PROCESSES						
16a. Identify median and mode			x	x		
16b. Compute averages			x	x		
16c. Solve problems combining all processes using whole, mixed numbers, and fractions	x					
16d. Solve problems, combining all processes, involving units of measurement	x					
16e. Interpret information from charts, number lines, scales, and graphs to solve arithmetic problems	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
16f. Solve conversion problems of linear (metric and Engligh (liquid, weight, and temperature (F degree or C degree) measures	x					
16g. Solve problems involving ratio and proportion	x					
16h. Solve word problems where any mathematical process may occur	x					
GRAPHING IN THE COORDINATE PLANE						
17a. Identify coordinates of a point in any grid system			x	x		Diagrams necessary
17b. Identify points on a line graph			x	x		Diagrams necessary
17c. Match a graph with its equation			x	x		Diagrams necessary
ALGEBRA						
18a. Solve simple algebraic equations with one unknown		x		x		
18b. Recognize and derive equivalent algebraic expressions						
18c. Evaluate powers and estimate roots			x	x		
TRIGONOMETRY						
19a. Use tables of trigonometric functions	x					
19b. Use tables of logarithms to solve problems	x					
19c. Solve geometric problems using trigonometric functions	x					
19d. Use trigonometric ratios to solve problems	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
PROCEDURAL DIRECTIONS						
25a. Identify factual details or specifications that are found within a statement or written selection	x					
25b. Select parts of text and visual materials to complete a task activity	x					
25c. Follow highly-detailed, step-by-step directions in order to accomplish a sequence of task activities	x					
25d. Determine the essential message of a paragraph or section of written material	x					
25e. Infer from a written source, which does not explicitly provide required information, in order to make a decision	x					
25f. Synthesize information from written sources which contributes to the completion of a task activity	x					
VOCABULARY						
26a. Recognize common words and their meanings			x	x		
26b. Recognize task-related words with technical meanings			x	x		
26c. Identify the correct meaning of a word from the context of a sentence	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
26d. Recognize the meaning of common contractions, *abbreviations, and acronyms*			x	x		
26e. Determine the meaning of figurative, idiomatic, and technical terms by using context clues or by using a reference source(s)	x					
REFERENCE SKILLS						
27a. Locate a Technical Manual, Field Manual, or any related source document by code number and title	x					
27b. Alphabetize words or topics to locate information	x					
27c. Use the table of contents, index, system, or sub-system heading, appendix, and glossary to locate information	x					
27d. Locate the page, title, paragraph, figure, or chart needed to answer a question or to solve a problem	x					
27e. Determine, after scanning or skim-reading, whether the information is relevant	x					
27f. Cross-reference within and across source documents to select information needed to perform a routine	x					
27g. Organize information from multiple sources into a sequenced series of events	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
TABLES/CHARTS						
28a. Obtain a fact or specification from a two-column table or chart to find information	x					
28b. Obtain a fact or specification from an intersection of a row by column table or chart	x					
28c. Use a complex table or chart requiring cross-referencing within or in combination with text material outside the chart	x					
28d. Apply information from tables and charts for locating malfunctions, or for selecting a course of action	x					
ILLUSTRATIONS						
29a. Identify details, labels, numbers, and parts from an illustration or picture	x					
29b. Identify parts or details according to a key or legend	x					
29c. Interpret a drawing which shows a cross-sectional view of an object for assembly, disassembly	x					
29d. Interpret a three dimensional projection or exploded view of object(s) for assembly, disassembly, or position in system or sub-system	x					
29e. Follow illustrations or photographs, arranged in a sequential order as a guide	x					
29f. Integrate information from various sources to select a course of action	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
FLOW CHARTS						
30a. Use a simple linear path of an organizational chart to list events in sequential order		x				
30b. Use a linear path of a flow chart to provide visual and textual directions to a procedure, to arrive at decision points, and to provide alternate paths in problem-solving		x				
30c. Translate the significance of the symbols into physical activities		x				
SCHEMATICS						
31a. Isolate each major section or entity presented in a schematic diagram		x				
31b. Identify the components within each entity		x				
31c. Trace connections in an integrated circuit from their origin to another point within or from one entity to another		x				
31d. Isolate a problem component in a schematic and trace it to components believed to cause the problem		x				
31e. Interpret symbols to indicate direction of flow, test points, components, and diagrammatic decision points		x				

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
FORMS						
32a. Locate the block on a form to enter the appropriate information	x					
32b. Transfer a number, code, date, figure or related data from equipment, or written sources onto an appropriate section of the form	x					
32c. Write the name of the organization, responsible personnel, disposition of the part or equipment, and nomenclature, in appropriate sections of the form	x					
32d. Write a descriptive account of an activity or transaction performed	x					
32e. Use a competed form to locate or compare information	x					
NOTE-TAKING						
33a. Distinguish between essential and non-essential details during the note-taking process	x					
33b. Record details without misinterpreting the intent of either written material or an interview	x					
33c. Rewrite all recorded details in sentence form	x					
33d. Organize all sentences into paragraphs	x					

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
OUTLINING (topic or sentence)						
34a. Distinguish between major and subordinate topics			x			
34b. Generate titles for each major topic selected			x			
34c. Use phrases or sentences to provide subordinate details under each major topic			x			
34d. Alternate, indent numbers, and letters to establish a hierarchy			x			
REPORT WRITING						
35a. State the intent or objective(s) of the report			x			
35b. Describe the parameters of the event or situation			x			
35c. Distinguish between relevant and irrelevant details			x			
35d. Sequence events in the order they have occurred			x			
35e. State general impressions of events described			x			
35f. Select examples that will clarify major issues presented in the report			x			
35g. Examine opposing points of view in the report			x			

Table 4 (Continued)

Prerequisite Competency	Not Usable	Usable Whole	Usable Part	With Book	Without Book	Comments
35h. Summarize the major points developed in the report	x					
35i. Justify an action taken and give reasons for rejecting alternatives	x					
EDITING						
36a. Spell frequently used words correctly			x	x		Some words can be given by audio
36b. Spell task-related words correctly			x	x		Some words can be given by audio
36c. Identify words that need to be capitalized			x	x		
36d. Correct all misspelled words with or without the use of a reference source			x	x		Reference sources should be made available
36e. Apply all rules for end marks, commas, and apostrophes	x					
36f. Apply common rules of grammar	x					
36g. Rewrite the paragraph by stating the main idea in the first sentence, and restructuring the sentences for coherence	x					
36h. Appraise an entire written communication and make adjustments to improve clarity	x					

Table 4 (Continued)

Prerequisite Competency	Not Usabl	Usable Whole	Usable Part	With Book	Without Book	Comments
PRECAUTIONS						
40a. Use common knowledge to avoid hazards in order to prevent injury to self or equipment	x					
40b. Apply preventive measures prior to task performance to minimize any potential safety or security problem	x					
40c. Select an appropriate course of action in the event of an emergency	x					
RECOGNITION						
41a. Identify similarities and differences between and among objects			x	x		
41b. Use body language (motions, gestures, postures) to communicate or signal	x					
41c. Determine the presence of a defect or extent of damage	x					
41d. Match objects by size, shape, color, and significant markings			x	x		
41e. Classify objects by size, shape, color, and significant markings			x	x		
41f. Determine direction, duration, and intensity of sounds, sightings, and smells	x					
41g. Infer from sights, sounds, touch, smells, or tastes to determine a course of action	x					
41h. Interpret codes and symbols	x					

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GLOSSARY OF TERMS

Basic skills objectives - a written description of the essential skills needed to learn and perform a military job; i.e., reading, computations, language, writing, and speaking skills.

Hierarchies - a graphic display which portrays the relationships among learning tasks in which some tasks must be mastered before others can be learned.

Indicator Statements - contract products which illustrate precisely how each of the prerequisite competencies (PCs) are used in each of the anlayzed Military Occupational Specialities (MOS).

Lesson Specifications - the prescribed lesson design for each of the prerequisite competencies analyzed by RCA Educational Services.

Learning Strategy - A learning strategy is a human information processing activity that facilitates acquisition, retention, and retrieval of representational and procedural knowledge in long-term memory. For example, various mnemonic strategies have been developed to facilitate memorization.

Metastrategy - A metastrategy is a higher level framework or structure that consists of steps, each step representing a category of learning strategies. In the JSEP curriculum, the metastrategy consists of five steps:

(1) Set Goal and Pace
(2) Mood Management
(3) Comprehensive Monitoring
(4) Memorize when Necessary
(5) Practice

Each of these steps represent a group of strategies, one or more of which could be used to accomplish that step, depending on the type of material to be learned. Therefore, a learner is taught a metastrategy as an executive framework, or general study approach for each lesson.

PLATO - acronym for University of Illinois' computer based system, Programmed Logics for Automated Teaching Operation.

Prerequisite Competencies - term defined by RCA as a generic basic skill that soldiers must have in order to learn specific tasks on their skill level 1 and 2 jobs.

RCA Taxonomy - a statement of skills developed on the RCA project. The skills are directly related to task performance and are based on excerpts from analysts work related to skills and knowledges that underlie task performance.

TICCIT - acronym for Hazeltine Corporation's computer based system, Time-shared, Interactive, Computer Controlled Information Television.

APPENDIX A

PRODUCTS RECEIVED FROM RCA

PRODUCTS RECEIVED FROM RCA EDUCATIONAL SERVICES

Report Title		
Analysis Data	Partial Shipment-MOS 57H, 61C, 67G, 67T, 68B, 68D, 68F, and 68H	Feb. 15, 1983
Task Statement List		March 10, 1983
Analysis Data	Partial Shipment-MOS 05B, 05C, 13F, 15D, 16D, 16E, 26L, 26Q, 31M, 43M, 44B, 44E, 57E, 61B, 63H, 68J, 91B	March 10, 1983
Analysis Data	Partial Shipment-MOS 11B, 11M, 63G, 63W, 67U, 68G, 71D, 71L, 71Q, 75B, 76X, 96B	March 14, 1983
Prerequisite Competency Indicator Statement List	Partial Shipment-05B, 15D, 16D, 16D, 16E, 26L, 31M, 43M, 44B, 44B, 61B, 63H, 63W, 67U, 68G	March 14, 1983
Prerequisite Competency Indicator Statement List	Partial Shipment-67;G, 68B, 68D, 68J, 71D, 71L, 71Q, 75B, 76X, 71B, 96B	March 17, 1983
Prerequisite Competency Indicator Statement List	05C, 13F, 26Q, 57E, 67T, 68F, 68H	March 17, 1983
Prerequisite Competency Indicator Statement List	05G, 11H, 11M, 12B, 13B, 13E, 17C, 17K, 57H, 61C, 63G, 67N, 67V, 67Y, 68M	March 21, 1983
Analysis Data	05G, 11H, 12B, 13B, 13E, 17C, 17K, 33S, 67N, 67Y, 68M	March 24, 1983
Prerequisite Competency Indicator Statement List	11B, 33S, 45B, 45K, 64C, 74D, 74F 74F	March 24, 1983
Analysis Data	31V, 45B, 45K, 67V, 74D, 74F	March 28, 1983
Prerequisite Competency Indicator Statement List	15E, 16H, 16P, 17B, 31V	March 28, 1983
Analysis Data	11C, 16H, 16P, 17B, 19D, 19E, 24C, 32D, 36C, 52C, 54E, 62B, 62E, 63N, 64C, 72E, 76Y, 82C, 93J, 95B, 95C, 15E	March 31, 1983

Prerequisite Competency Indicator Statement List	000, 11C, 19D, 19E, 24C, 24H, 32D, 35K, 36C, 36K, 43E, 52C, 52D, 54E, 55B, 55D, 62B, 62E, 63N, 71M, 71P, 72E, 76C, 76P, 76V, 76W, 76Y, 82C, 93J, 94B, 95B, 95C	March 31, 1983
Analysis Data	000, 24H, 31J, 36K, 43E, 52D, 55D, 71P, 76C, 76P, 76V, 76W, 94B	April 4, 1983
Prerequisite Competency Indicator Statement List	27E, 31J, 31N, 32H	April 4, 1983
Analysis Data	27E, 31N, 32H, 35K, 55B, 71M	April 18, 1983
Knowledge Statement List		April 18, 1983
TPA-3	11 tasks in MOS 91B (represents specific medical related knowledge)	April 26, 1983
Complete Prerequisite Competency Indicator Statement List for "old format" MOS		April 27, 1983
Discrepancy Statement List		April 27, 1983
Revised Task Statement List in MOS order	05B, 05C, 05G, 11B, 11C, 11H, 11M, 12B, 13B, 13E, 13F, 15D, 15E, 16H, 17B, 17K, 19D, 19E, 31V, 36C, 54E, 61C, 62B, 67G, 67N, 68J, 71D, 71M, 71P, 95B	May 4, 1983
Complete Task Statement List (in Task Number Order)		May 4, 1983
Complete Prerequisite Competency Indicator Statement List (new format, MOS-BSEPI)	All MOS	May 13, 1983
Complete Prerequisite Competency Inicator Statement List (new format MOS-BSEPII)		May 17, 1983
Subtask Statement List		May 18, 1983
Compute Subtask List		May 18, 1983
Curricula Model Analysis		May 23, 1983
Executive Summary		June 9, 1983

(Phase I)

Prerequisite Competency/ MOS Matrix		June 13, 1983
MOS Baseline Skills Profile	05B, 05C, 05G, 11B, 11C, 11H, 12B, 13B, 13E, 13F, 15D, 15E, 16D, 16E, 16H, 16), 17B, 26L, 26Q, 27E, 31J, 31M, 31N, 31V, 32D, 32H, 33S, 35K, 36C, 36K, 43E, 43M, 44B, 44E, 45B, 57E, 57H, 61B, 61C, 62B, 62E, 63G, 63H, 63N, 63W, 64C, 67G, 67N, 67T, 67U, 67V, 67Y, 68B, 71D, 71L, 71M, 71P, 71Q, 72E, 74D, 74F, 75B, 76C, 76P, 76V, 72W, 76X, 76Y, 82C, 91B, 93J, 17C, 17K, 19D, 19E, 24C, 24H, 45K, 52C, 52D, 54E, 55B, 55D, 68D, 68F, 68G, 68H, 68J, 68M, 94B, 95B 95C, 96B, Common Tasks	June 28, 1983
Initial Entry Training Course Survival Skill (IETCSS) List		June 30, 1983
2nd Copy of EITCSS List		July 7, 1983
Preliminary Initial Entry Training Course Survival Skill (IETCSS) Report		July 12, 1983
IETCSS Analysis Report (Final)		July 26, 1983
Clustering Report (Final)		August 3, 1983
Attachment C for Curricula Model Analysis Report		August 9, 1983
Attachment F for Executive Summary (Phase 1) Report		August 22, 1983
Design Specifications	Complete set	Sept. 14, 1983

ATTACHMENT B

RCA Taxonomy

NUMERATION/PLACE VALUE

NT

1. NUMBERING AND COUNTING

- a. Match numerals with word names and models
- b. Write numerals one through N in sequential order from any starting point
- c. State what numeral comes after, before, or between any two given numerals
- d. Select the numeral which is greater/lesser from a set of numerals
- e. Identify an object with a specified ordinal position
- f. Write or state the place value of a particular digit, whole or decimal number
- g. Round off a number to a specified place, whole or decimal
- h. Count by ones, twos, fives, tens, etc. backward or forward (skip counting)
- i. Match numbers with points or intervals on a number line (positive (+) or negative (-) values)

UNITS OF MEASUREMENT

2. LINEAR, WEIGHT, AND VOLUME MEASURES

- a. Name the markings on a linear scale
- b. Differentiate units of measure and equivalents in the English and metric system
- c. Use a ruler, yardstick, meter stick or scale to measure lengths of objects or distances
- d. Identify measures of ounce, pound, gram
- e. Identify measures of pints, quarts, gallons, liters
- f. Use a scale which is not numerically calibrated
- g. Estimate measures of varying lengths, dimensions or weights

3. DEGREE MEASURES

- a. Identify degree or mil as a unit in determining direction, distance or temperature
- b. Estimate the measure of a given angle not greater than 180^{o}
- c. Interpret bearings, azimuth and other contexts in which the measure of an angle may range from 0^{o} to 360^{o}/0 to 6400 mils

4. TIME-TELLING MEASURES

- a. Use a 24-hour or digital clock to tell time
- b. Name intervals and tell time in hours, minutes, and seconds
- c. Estimate time in seconds, minutes, and parts of an hour
- d. Identify calendar units and arrange them in Julian style
- e. Convert time into hours and tenths of hours
- f. Compute time using Greenwich Mean Time (GMT) as a basis for establishing zones and distances

NT

5. GAUGE MEASURES

- a. Identify the unit of measurement found on an instrument
- b. Interpret the number, word, symbol from a display read-out
- c. Recognize a "reading" from a gauge with color divisions
- d. Recognize positive (+) and negative (-) demarcation on a scale
- e. Select band(s) from a multi-scale gauge
- f. Match a gauge reading to a specification using numbered or labeled intervals
- g. Interpret gauge readings from an unnumbered/unmarked interval
- h. Interpret a gauge reading which is fluctuating or momentarily sustained
- i. Match specifications of required measures by manipulation, alignment or maintenance

VISUAL/SPATIAL RELATIONSHIPS

6. SPATIAL

- a. Identify directions that tools, hardware, or components may be moved
- b. Manipulate objects to align, match, mate, make parallel, be perpendicular or be at an angle
- c. Interpret spatial relationships of figures and objects from 2-dimensional drawings, pictures, or photographs
- d. Relate geometric symbols and graphic representations to actual systems, subsystems and components

GEOMETRY

7. LINES

- a. Identify and name points, lines, rays, and segments
- b. Identify intersecting lines, parallel lines, and line segments
- c. Define and identify perpendicular lines
- d. Identify congruent segments

8. PLANES

- a. Identify and name plane geometric figures
- b. List the characteristics of geometric figures
- c. Classify figures according to the number or measure of its sides or angles
- d. Identify figures which possess similarities
- e. Identify figures which may be parallel, perpendicular or congruent

9. ANGLES AND TRIANGLES

- a. Identify and name the different kinds of angles and triangles, with their corresponding figures
- b. Identify vertical, adjacent, complementary or supplementary angles
- c. Classify triangles according to their sides or angle-size
- d. Identify altitudes and medians of triangles or the bisector of an angle
- e. Name an angle by using letters, a number, or a single letter

CONTENT READING

NT

25. PROCEDURAL DIRECTIONS

- a. Identify factual details or specifications that are found within a statement or written selection
- b. Select parts of text and visual materials to complete a task activity
- c. Follow highly-detailed, step-by-step directions in order to accomplish a sequence of task activities
- d. Determine the essential message of a paragraph or section of written material
- e. Infer from a written source, which does not explicitly provide required information, in order to make a decision
- f. Synthesize information from written sources which contributes to the completion of a task activity

26. VOCABULARY

- a. Recognize common words and their meanings
- b. Recognize task-related words with technical meanings
- c. Identify the correct meaning of a word from the context of a sentence
- d. Recognize the meaning of common contractions, abbreviations and acronyms
- e. Determine the meaning of figurative, idiomatic, and technical terms by using context clues or by using a reference source(s)

INFORMATION ACCESS

27. REFERENCE SKILLS

- a. Locate a Technical Manual, Field Manual or any related source document by code number and title
- b. Alphabetize words or topics to locate information
- c. Use the table of contents, index, system or sub-system heading, appendix and glossary to locate information
- d. Locate the page, title, paragraph, figure, or chart needed to answer a question or to solve a problem
- e. Determine, after scanning or skim-reading, whether the information is relevant
- f. Cross-reference within and across source documents to select information needed to perform a routine
- g. Organize information from multiple sources into a sequenced series of events

28. TABLES/CHARTS

- a. Obtain a fact or specification from a two-column table or chart to find information
- b. Obtain a fact or specification from an intersection of a row by column table or chart
- c. Use a complex table or chart requiring cross-referencing within or in combination with text material outside the chart
- d. Apply information from tables and charts for locating malfunctions, or for selecting a course of action

VISUAL AIDS

NT

29. ILLUSTRATIONS

- a. Identify details, labels, numbers, and parts from an illustration or picture
- b. Identify parts or details according to a key or legend
- c. Interpret a drawing which shows a cross-sectional view of an object for assembly, disassembly
- d. Interpret a three dimensional projection or exploded view of object(s) for assembly, disassembly, or position in system or sub-system
- e. Follow illustrations, or photographs, arranged in a sequential order, as a guide
- f. Integrate information from various sources to select a course of action

30. FLOW CHARTS

- a. Use a simple linear path of an organizational chart to list events in sequential order
- b. Use a linear path of a flow chart to provide visual and textual directions to a procedure, to arrive at decision points, and to provide alternate paths in problem-solving
- c. Translate the significance of the symbols into physical activities

31. SCHEMATICS

- a. Isolate each major section or entity presented in a schematic diagram
- b. Identify the components within each entity
- c. Trace connections in an integrated circuit from their origin to another point within or from one entity to another
- d. Isolate a problem component in a schematic and trace it to components believed to cause the problem
- e. Interpret symbols to indicate direction of flow, test points, components and diagrammatic decision points

WRITTEN COMMUNICATION

32. FORMS

- a. Locate the block on a form to enter the appropriate information
- b. Transfer a number, code, date, figure or related data from equipment or written sources onto an appropriate section of the form
- c. Write the name of the organization, responsible personnel, disposition of the part or equipment, and nomenclature, in appropriate sections of the form
- d. Write a descriptive account of an activity or transaction performed
- e. Use a completed form to locate or compare information

33. NOTE-TAKING

- a. Distinguish between essential and non-essential details during the note-taking process
- b. Record details without misinterpreting the intent of either written material or an interview
- c. Rewrite all recorded details in sentence form
- d. Organize all sentences into paragraphs

NT

10 SOLIDS

- a. Recognize and match the names of solids with their corresponding figures

11. TERMINOLOGY

- a. Identify technical words associated with geometric figures
- b. Interpret meaning of terms derived from spatial orientation

COMPUTE OR PERFORM

12. ADDITION AND SUBTRACTION

- a. Add or subtract whole numbers, without carrying or borrowing
- b. Add or subtract whole numbers, carrying and borrowing
- c. Add and subtract, borrowing and carrying with mixed numbers (whole and decimals)
- d. Add or subtract positive (+) and negative (-) numbers, using a number line to arrive at a solution
- e. Add or subtract to find correct time (24 hr. clock) using hours or minutes
- f. Add or subtract various increments on gauges, dials, or any other measuring instrument
- g. Add or subtract time, linear, dry, liquid or degree measures requiring regrouping
- h. Estimate a sum or difference

13. MULTIPLICATION AND DIVISION

- a. Multiply and divide whole numbers
- b. Multiply and divide mixed numbers (whole and decimals)
- c. Divide a number with decimals in both divisor and dividend
- d. Multiply and divide integers, both positive (+) and negative (-), and assign proper sign to product or quotient
- e. Estimate a product or quotient

14. FRACTIONS/DECIMALS

- a. Subdivide whole objects or a set of objects into halves (1/2), thirds (1/3), fourths (1/4), eighths (1/8)
- b. Reduce fractions to lowest terms
- c. Convert fractions (proper and improper) to decimal equivalents, and vice versa, using a table, chart or gauge
- d. Compute equivalent value of fractions, decimals, percents, and mixed numbers to lowest terms
- e. Add and subtract fractions, with same or different denominators
- f. Multiply and divide fractions with and without whole numbers
- g. Estimate a fractional sum, product, or quotient

NT

15. GEOMETRY

- a. Draw geometric figures, plane and solid
- b. Match geometric figures with word names, equivalent measures
- c. Label all parts of geometric figures using mathematical and characteristic designators
- d. Use a protractor to measure angles, make geometrical constructions
- e. Construct perpendicular on a line segment, bisector of an angle
- f. Compute the perimeter and area of any figure
- g. Compute the circumference and area of a circle
- h. Compute the area and volume of any solid figure
- i. Use formulas in solving problems involving geometric figures
- j. Solve problems and interpret spatial relationships of figures, symbols, and objects from 2-dimensional displays

16. COMBINATION OF PROCESSES

- a. Identify median and mode
- b. Compute averages
- c. Solve problems combining all processes using whole, mixed numbers and fractions
- d. Solve problems, combining all processes, involving units of measurement
- e. Interpret information from charts, number lines, scales and graphs to solve arithmetic problems
- f. Solve conversion problems of linear (metric and English) liquid, weight, and temperature (F^{O} or C^{O}) measures
- g. Solve problems involving ratio and proportion
- h. Solve word problems where any mathematical process may occur

17. GRAPHING IN THE COORDINATE PLANE

- a. Identify coordinates of a point in any grid system
- b. Identify points on a line graph
- c. Match a graph with its equation

18. ALGEBRA

- a. Solve simple algebraic equations with one unknown
- b. Recognize and derive equivalent algebraic expressions
- c. Evaluate powers and estimate roots

19. TRIGONOMETRY

- a. Use tables of trigonometric functions
- b. Use tables of logarithms to solve problems
- c. Solve geometric problems using trigonometric functions
- d. Use trigonometric ratios to solve problems

NT

34. OUTLINING (topic or sentence)

- a. Distinguish between major and subordinate topics
- b. Generate titles for each major topic selected
- c. Use phrases or sentences to provide subordinate details under each major topic
- d. Alternate, indent numbers and letters to establish a hierarchy

35. REPORT WRITING

- a. State the intent or objective(s) of the report
- b. Describe the parameters of the event or situation
- c. Distinguish between relevant and irrelevant details
- d. Sequence events in the order they have occurred
- e. State general impressions of events described
- f. Select examples that will clarify major issues presented in the report
- g. Examine opposing points of view in the report
- h. Summarize the major points developed in the report
- i. Justify an action taken and give reasons for rejecting alternatives

36. EDITING

- a. Spell frequently used words correctly
- b. Spell task-related words correctly
- c. Identify words that need to be capitalized
- d. Correct all misspelled words with or without the use of a reference source
- e. Apply all rules for end marks, commas, and apostrophes
- f. Apply common rules of grammar
- g. Rewrite the paragraph by stating the main idea in the first sentence, and restructuring the sentences for coherence
- h. Appraise an entire written communication and make adjustments to improve clarity

VERBAL COMMUNICATION

37. TYPE

- a. Individual – a person working on a task and communicating with another when assistance is needed or when a supervisory decision is needed
- b. Instruction – a task activity requiring communication between an instructor, an individual or small group where the purpose is to give facts or rules to inform or guide
- c. Tutor – interaction takes place between two persons where one is instructing and the other is doing the task
- d. Peer Group (less than 10) – all members engage in an activity where one person assumes a leadership role and communicates to others what is to be done
- e. Interview – a person communicating with another about his activities, opinions, or subject expertise for the purpose of using the information in a task
- f. Briefing – communicating final instructions to others or giving an account in summary
- g. Counsel – communicating together to exchange ideas or opinions to recommend, give or take advice, or to arrive at an acceptance of a plan or decision
- h. Command – communicate to others an order or action to be taken where a person has a position of authority

NT

38. CHARACTERISTICS

- a. Enunciate clearly, using the proper rate of speech
- b. Use technical vocabulary suitable to the task and level of the person
- c. Determine the appropriate amount of information to communicate
- d. Interpret figurative or idiomatic language by reference to its use in context
- e. Follow highly detailed, step-by-step directions
- f. Solicit feedback to confirm the accurate reception of the communication
- g. Recognize when a low-key, informal dialogue is suitable
- h. Recognize when direct verbal commands are necessary
- i. Recognize when a prescribed series of verbal interactions is required to coordinate a group effort
- j. Recognize when the situation will require a structured, preplanned method of presentation

39. BARRIERS

- a. Recognize the need for clear, concise directions in order to avoid language or word-meaning differences
- b. Recognize personality factors and inter-personal relationships that may exist
- c. Recognize feedback as a means of communicating more effectively and increasing task competence

SAFETY/SECURITY

40. PRECAUTIONS

- a. Use common knowledge to avoid hazards in order to prevent injury to self or equipment
- b. Apply preventive measures prior to task performance to minimize any potential safety or security problem
- c. Select an appropriate course of action in the event of an emergency

PERCEPTUAL

41. RECOGNITION

- a. Identify similarities and differences between and among objects
- b. Use body language (motions, gestures, postures) to communicate or signal
- c. Determine the presence of a defect or extent of damage
- d. Match objects by size, shape, color and significant markings
- e. Classify objects by size, shape, color and significant markings
- f. Determine direction, duration, and intensity of sounds, sightings and smells
- g. Infer from sights, sounds, touch, smells, or tastes to determine a course of action

APPENDIX C

LEARNER STRATEGIES CONCEPTS

LEARNER STRATEGIES CONCEPT PAPER

Sharon Derry
Debra Murphy

Center for Educational Technology
Florida State University

Here, the term learning strategy refers to the mental operations a student employs in an instructional situation to acquire different kinds of knowledge and performance. While studying, for example, a student might use particular mental techniques for minimizing stress, memorizing text, and maintaining attention. Thus conceived, learning strategies lie within the domain of cognitive strategies (Bruner, Goodnow & Austin, 1956; Gagne, 1980), a broader family of capabilities that enable individuals to exercise control over their own intellectual processes.

Some researchers (e.g., Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, & Evans, 1979; Butterfield & Belmont, 1977; McCombs & Dobrovolny, 1982; Weinstein, 1982) have argued that direct training of strategies, as might be provided by a study skills course, can improve students' abilities to learn, remember, and solve problems. We believe that cognitive strategies should be acquired gradually as by-products of practice and experience.

Gagne (1980) has expressed doubt that strategic thinking can be "trained" in the usual sense of the word. He points out the enormous diversity of task-specific cognitive strategies, and the experiential aspects of their natural evolution. Thinking skills, he argues, are adaptive intellectual capabilities that evolve gradually through contact with many different learning situations. If this is true, then the typical study skills course would not be likely to provide the rigorous and extended practice that is needed in order for learning skills to develop. To achieve direct training of strategies, the curriculum design must recognize and accommodate the evolutionary aspects of strategies acquisition.

This paper describes a strategies training model that attempts to engineer the instructional environment following study skills training, so that students are required to invoke and employ previously taught thinking skills in a variety of actual learning situations. Our model conceptualizes strategies acquisition as a form of incidental learning, embedded within the context of a primary curriculum based on subject-matter learning goals. A version of this model is exemplified by the Job Skills Education Program (JSEP).

The curriculum provides direct instruction in:

1. the use of a general learning strategy for approaching basic-skills computer based instruction (CBI) lessons, and

2. a variety of simple component strategies that can be used to accomplish the general strategy.

A second feature of the model is a prompting system, embedded within the basic skills lessons, that

1. Analyzes student response patterns to determine whether previously taught learning strategies are being utilized.

2. Prompts students, at appropriate times, to invoke and utilize strategies.

3. Gradually phases out prompts in advanced stages of instruction, when there is sufficient evidence of spontaneous strategies initiation.

The discussion here develops a rationale for the approach, which is consistent with research on incidental learning (Craik & Lockhart, 1972; Craik & Tulving, 1975), follows Sternberg's guidelines for intellectual skills training (1983), and is congruous with what Gagne (1980) has written about how cognitive strategies are acquired.

Strategies Initiation: Awareness and Control

One feature of JSEP which distinguishes it from previous basic skills curricula, such as the McFann-Gray (McGuire, Avant, & Howard, 1982) or SRA (1969)is that JSEP attempts to develop student awareness and automatic control of learning strategies. Although a learning strategy is always carried out by the student, initiation and control of its use may arise primarily from the student's own self-instructions (learner-controlled), or from an instructional system (lesson-controlled).

Furthermore, student awareness of strategy use can vary; and thus, a continuum is conceptualized, ranging from conscious to subconscious processing. A conscious strategy can be described independently of the subject matter; the student is aware of its existence in a metacognitive (Brown, 1980) sense.[1] A subconscious strategy may be lesson-controlled if it is deliberately "forced" by the instructional design, or student-controlled if it is not. In either case, the learner is not spontaneously aware of its use. These distinctions resemble those made by Rigney (1978, 1980). They suggest the four concep-tualizations of learner strategies presented in Table 1.

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1. Brown (1980) defines the term Metacognition as the deliberate, conscious control of one's own cognitive actions.

Table 1
Four Types of Learning Strategies

Awareness of Learner Strategy	Student Controlled	Lesson Controlled
Conscious	A	B
Subconscious	C	D

Consider a student attempting to learn the text material presented by a training manual. If the student deliberately adopts a strategy involving the use of paraphrase, imagery and self-generated questions, this would be an example of combination A. But, if the textbook directly instructs the student in the use of this strategy, this would exemplify combination B. Rigney's premise was that combination A of Figure 1 is desirable, at least in many circumstances. He argued that when students have not naturally acquired appropriate strategies for learning, combination A might be realized through implementation of combination B. In early phases of a training program, instruction would explicitly point out that there are strategies that can be applied to facilitate learning of the subject content. As the student progresses and develops greater skill with the subject, strategy training can be phased out, leading ultimately to combination A (Rigney, 1978).

Combination C is illustrated by the situation in which the student has evolved, through experience with a particular type of material, a processing method that is so spontaneous and automatic, there is no conscious awareness of its initiation and use. The widely accepted resource allocation model of attention (Norman & Bobrow, 1975) suggests that automaticity is a highly desirable long-range goal for strategies training. Automatic strategies initiation is believed to free attentional resources that can be devoted to processing of content based instruction.

Whether or not any form of learner strategies training can lead to C is an important empirical question that has not yet been resolved. Rigney (1980) suggested that extended practice of a newly acquired strategy, as in mode A, could help develop the type of automaticity that is a desirable characteristic of the subconscious, student-controlled strategy. Another theorist (Brown, 1980) also has proposed that one route to automatic processing is through initial training in "metacognitive awareness." Forthcoming discussions will clarify how JSEP endeavors to engineer spontaneous initiation of new strategies, by moving the student from conscious, lesson-controlled processing, through what might be termed the metacognitive phase, toward a smoother, more automatic form of processing.

In contrast to the JSEP approach, most basic skills curricula represent situation D, the lesson-controlled counterpart to automatic processing. This instructional design methodology involves incorporating controls into a

lesson, so that students are required to employ particular processing strategies in order to accomplish subject-matter orienting tasks. For example, inserted questions (Anderson & Biddle, 1975; Andre, 1979; Rickards, 1976) may be used to foster imaging and depth processing. Or, through explanation techniques based on metaphor and analogy (Ortony, 1975; Rumelhart & Norman, 1981), or the advance organizer (Ausubel, 1968; Ausubel, Novak & Hanesian, 1978), students might be required to encode new information in the context of a particular prior knowledge structure. In the field of instructional development, current standards are dominated by the methodologies of Gagne and Briggs (Briggs, 1977; Gagne, 1977; Gagne & Briggs, 1974), which rely on subconscious, lesson-controlled strategies supplied by the instructional designer as part of an event called "learning guidance."

Although the effects of lesson-controlled strategies have now been documented by a substantial corpus of literature, our review of that literature reveals few, if any, totally dependable instructional techniques. With the possible exception of "forced" practice-and-feedback, no single, isolated instructional device that will greatly enhance pedagogical effectiveness is known. By contrast, some explicitly taught learner-controlled techniques, such as mnemonics and pegword systems, have significantly enhanced memory, at least for lists and paired associates (Bower, 1970, p.500).

Furthermore, we agree with Rigney (1978) that hidden strategies do little to help the student cope with requirements for further independent learning of material that is not highly "designed"--a technical manual accompanying electronic equipment, for example. Yet, the notion of subconscious, lesson-controlled strategies has strong intuitive and theoretical appeal. If thought control can totally be relinquished by the student to the instructional system, more of the learner's activation resources presumably are available for concentrated processing of subject-matter material. Thus, it might be argued that situation D represents the most efficient form of instruction, when strategies acquisition is not an important instructional goal.

Cognitive Strategies, Intellectual Skills, and Cognitive Style

Gagne (1977) has defined five types of subject-matter for which a training curriculum can be developed:

1. cognitive strategies,
2. intellectual skills,
3. verbal information,
4. motor skills, and
5. attitudes.

In Gagne's terminology, JSEP represents an intellectual skills curriculum. Soldiers enter JSEP to acquire the prerequisite math and verbal competencies that will enable them to learn their military tasks. However, it is necessary in this context to make an important distinction between Gagne's conceptu-

alization of intellectual skills training, and another well-known use of this same phrase, derived largely from theories of intelligence and popularized by Sternberg.

Gagne (1977) has identified five progressively complex classes of intellectual skills: discriminations, concrete concepts, defined concepts, rules, and higher-order rules. To acquire the skill of "making change," for example, the student first must be able to distinguish coin types from one another, and to identify them by name and monetary value. The rules of addition, subtraction, and monetary equivalence also must be acquired. These concepts and rules, which are identified by a cognitive task analysis of the to-be-learned operation, become either the prerequisite competencies or the subject-matter objectives for a skill lesson.

This subject matter does not include direct training in how to conduct the cognitive processes actually involved in making the discriminations, acquiring concepts, or committing rules to memory. The instruction is designed to facilitate, rather than teach or explain, the learning process.

In contrast, the purpose of intellectual skills training, as implied by Sternberg's (1983) use of the phrase, is to improve the processing intelligence of the learner. Sternberg has developed a method for isolating elemental component thinking processes that underlie various types of skilled per-formance, and has suggested guidelines for design of process-oriented training to improve the speed and facility with which the learner carries out actual thinking operations.

Intelligence training has two aims:

1. to sharpen the learner's component processing abilities, and

2. to improve the learner's ability to formulate higher-order cognitive strategies, which combine component processes.

Intensive practice has supplied an important key in the training of component processes. Frederickson (1983), for example, has developed intelligent computer games that successfully improve components underlying reading skill, such as letter-group perception speed, through continuous computer-controlled practice and feedback. Practice also plays a key role in the evolution of higher-order cognitive strategies. However, strategies development probably calls for a more programmatic training approach that supplies highly varied practice over an extended period of time.

Sternberg's notion of the intellectual skill differs from Gagne's, but is more than roughly equivalent to Gagne's notion of "cognitive strategy." (From Gagne's point of view, one of Sternberg's "component processes" would amount to no less than a prerequisite competency for acquiring a particular cognitive strategy.) Here, we will follow Gagne's (1980) convention of distinguishing between cognitive strategy and intellectual skill as two distinctly different forms of human capability.

This distinction already is well-established in the field of instructional design. It helps clarify the nature of the JSEP model, which embeds cognitive strategies training within an intellectual skills curriculum.

The parallel between Gagne's notion of cognitive strategy and Sternberg's view of intelligence is emphasized, to make the point that in many respects, the JSEP approach to strategies training adheres to Sternberg's 1983 guidelines for training the intelligence. In this sense, it is argued that JSEP represents a large-scale, programmatic effort to improve a form of processing intelligence--ability to learn from a particular type of training system.

We most note that currently there is a trend toward differentiating the concept of processing intelligence from that of cognitive style. Cognitive styles have been defined as non-evaluative individual differences in modes of conducting thinking processes such as perceiving, attending, storing, remembering, transforming, and utilizing information. The notion of intellectual ability concerns processing capacity, which can vary on an evaluative continuum from low to high (Federico, 1980).

Because the JSEP introductory course includes direct, step-by-step instruction in processing mode, it could be argued that strategies training in JSEP is more appropriately described as an attempt to alter cognitive style rather than intelligence. We prefer the concept of cognitive strategy, and the idea that strategy can be taught as a means of obtaining more efficient and intelligent use of processing resources that may, in fact, be relatively limited. In this context, we draw no evaluative distinction between "intelligence" that results from efficient use of limited capacity resources, and that resulting from a larger resource allotment and less effectual strategy.

Embedding a Strategies Training Program

Sternberg's (1983) guidelines for improving the intelligence, as measured by standardized aptitude tests, emphasize the importance of providing appropriate linkages between the processing skills that are being taught and real-world processing situations. The usual method of insuring ecological validity involves requiring learners to process, during training, the types of materials they will encounter in their daily experience. For example, Sternberg notes that one of his programs trains the set of skills individuals use to learn the meanings of previously unknown words. If a job-relevant vocabulary list were employed during training, then students not only would acquire the ability to figure out the meanings of new words, but also may acquire as incidental learning, a vocabulary list that is personally germane. This approach amounts to embedding, within a strategies training program, secondary objectives based on what usually is regarded as the primary subject-matter in a functional basic skills curriculum.

Most programs designed to teach learning strategies have treated academic subject-matter as practice material. This approach is exemplified by the adjunct study-skills courses developed by McCombs (1982), Dansereau et al. (1979), and Weinstein (1982). These programs are stand-alone curricula in which strategies acquisition, rather than subject-matter learning, is the primary aim. They teach and provide practice in using general processing and self-management schemes that are "detached" (Rigney, 1980) from any particular curriculum, but presumably are applicable to a wide variety of learning situations. Study-skills courses have produced statistically significant, though modest, gains in student attitude, motivation, confidence, and in

certain types of school performance measures (Vaughan, 1981). A serious shortcoming of study skills courses is that they are unable to supply a real-world context for long-term, varied practice in strategies formulation.

Jones (1983) has argued in favor of embedded strategies training, which offers instruction and practice in learning strategies totally within the context of a curriculum based on subject-matter learning goals. Her approach incorporates explicit instructions on text processing strategy into subject-matter instructional materials received by teachers and students. One advantage to this approach is that it can be implemented without extensive in-service teacher training. Four types of strategies instruction can be embedded:

1. Step-by-Step Prompts, complex, multi-step thinking directions,

2. Think Aloud Models, simulated dialogues of a model student processing a portion of text,

3. Adjunct Study Questions, which require particular thinking processes, and

4. Study Prompts, reminders to use specific information processing strategies that have been taught previously.

Jones and her associates have developed several large-scale embedded strategies curricula that rely heavily on the first three types of embedded instructions, especially the step-by-step prompts. Jones' approach can be contrasted with that taken by Sticht (1979), who developed embedded curricula for low-achieving military recruits, based on a less obtrusive prompting method.

When nonobtrusive study prompts are employed, step-by-step strategies training occurs outside the actual learning event rather than in conjunction with subject-matter instruction. Brief reminders to use previously learned strategies are then inserted, at appropriate points, into new lessons based on more traditional subject-matter material. This prompting method is unique in that it encourages practice in the recall, as well as the use, of previously acquired learning strategies. Thus, it is more likely to encourage the development of independent processing.

Furthermore, since step-by-step strategies training is provided outside the actual learning event rather than in conjunction with subject-matter instruction, study prompts are less likely to disrupt concentration. Nonobtrusive prompts are a feature of the JSEP model, which treats strategies development as a form of incidental learning embedded within a functional basic-skills curriculum. Empirical and theoretical justification for the incidental strategies training approach is supplied in part by research based on the depth-of-processing paradigm (Craik & Lockhart, 1972; Craik & Tulving, 1975), which clearly has demonstrated that intention to learn is not a prerequisite for actually learning.

Metastrategies and Component Strategies

A learning strategy has been conceived by Dansereau (1978) as a mental construction that embodies both a situationally-relevant general metastrategy, and groups of component sub-strategies that are associated with the metastrategy. To initiate a strategy for learning, an individual must not only access an available library of component processing skills, but also select particular component processes, organize them into a metastrategy that matches a particular learning situation, and continuously monitor the success of the learning effort. The relationship between a metastrategy and its related substrategies parallels the link between what Sternberg (1983) has called "executive" and "nonexecutive" information processing routines. He argues that programs which attempt to train a form of intelligence " should provide explicit training in both executive and nonexecutive information processing, as well as interactions between the two kinds of information processing" (Sternberg, 1983, p. 9).

We conclude that strategies training systems should teach not only the essential component cognitive skills, but also a repetoire of metastrategies appropriate for frequently encountered learning situations. For example, Dansereau and his associates have taught college students to utilize MURDER, a mnemonic which stands for a sequence of steps in a general study strategy -- set your Mood, read for Understanding, Recall, Digest information (correct recall, amplify, and store), Expand knowledge through self-inquiry, and Review mistakes. A simple variation on this mnemonic is taught as a general heuristic for test-taking. Specific component processing skills associated with each step in these mnemonics also are taught: mood-setting may involve positive self-talk and progressive relaxation; amplification could be accomplished through imaging or paraphrasing.

When considered alone, a metastrategy that is general enough to be used for many types of lessons and curricula amounts to what Newell (1980) has called a "weak" strategy. The method is weak because it trades power for generality. However, when coordinated with embedded prompts to engage various specific processing techniques to accomplish a metastrategy, the technique becomes a model for training students in what Newell has called a "Weak to Strong Method Sequence." "The weak methods can be taken to be just the tip of the iceberg, so that there exists an expanding cone of methods of ever greater specificity and power. This is a variant of the Big Switch hypothesis, for at the base of the cone are the multitude of specific expert procedures" (Newell, 1980, p. 186).

We hypothesize that acquisition of a metastrategy will provide learners with an important link insuring continued initiation of component strategies, even after explicit prompts are deleted. A well established fact of memory research is that recall of high-order contextual categories effectively cues even long "forgotten" specific memories (Tulving, 1974; Marslen-Wilson & Teuber, 1975). In the same sense, recall and initiation of a simple, general response to an instructional situation could continue to cue an available library of more specific processing techniques. But, although the metastrategy technique provides a useful method for initially introducing students to the concept of learning strategies, as a training method it will prove insufficient unless followed by opportunity for frequent practice within

a curriculum that supplies an appropriate semantic context for strategies use and generalization.

The JSEP Strategies Training Program

An example of how adjunct strategies training, the metastrategy technique, and nonobtrusive prompting can be combined in a CBI curriculum is illustrated by JSEP. JSEP begins with an introductory learning strategies course consisting of two units: "Welcome to JSEP," and "Learning Skills You Need for JSEP." One lesson in the welcome unit, entitled "What JSEP lessons are Like," suggests that students employ a general metastrategy for approaching every basic skills CBI lesson.

The metastrategy consists of five elements:

1. Set Goal and Pace,
2. Control Your Mood,
3. Monitor Your Comprehension,
4. Memorize When Necessary, and
5. Practice Thoughtfully.

Each element of this metastrategy is introduced by a fictitious character whose image and name represents his or her particular concept. In further introductory lessons, specific component strategies that can be initiated by the learner to accomplish each metastrategy step are taught by the appropriate character. For example, mood management methods are introduced by a coach. In the final segment of the introductory course, entitled "Making Your Skills Work Together," the characters are pictured in scenes together so that they will become associated with one another as members of a cooperating group. The intent of this device is to create an "imagery mnemonic" that will cue students when they attempt to recall all steps in the metastrategy.

These characters also appear often within the basic skills lessons that compose most of the JSEP curriculum. Within the lessons, they function as part of an intelligent prompting system that analyzes student responses to determine whether or not the metastrategy is being utilized, and encourages soldiers when necessary, to consciously recall and employ their new learning skills. For example, students who are actively practicing the skill of comprehension monitoring will frequently use the review option for difficult-to-understand material.

If results of a comprehension posttest indicates lack of understanding, but the review counter has posted few or no reviews for that student, then a prompting character would begin to appear, encouraging use of the review option. This prompting procedure is analogous to establishing, in a problem-solving situation, what Bower (1975) and Gagne (1980) have called a learner set. "The effect of the set is to activate a cognitive strategy that persists during the time the processes of problem solving are being employed" (Gagne, 1980, p. 15).

One important difference between the JSEP system and most other forms of strategies training, particularly study-skills courses, is the attention which is paid by the former to development of automaticity. Most strategies training programs begin by raising the student's metacognitive consciousness. But, the embedded model implemented in JSEP further attempts to logistically engineer the change from the laborious activity of the conscious level to the" normal rapid automatic pilot state" that distinguishes subconscious processing (Brown, 1980).

Throughout the instructional program, students who need prompts are reminded to engage in the extensive and rigorous strategies practice that is known to be necessary for the development of automatic processing (Hirst, Spelke, Reaves, Caharack and, & Neisser 1980; Neisser, 1976; Rigney, 1980), or at least smooth performance. With the onset of spontaneous strategies initiation, reviews and prompts can be phased out, presumably in advanced stages of instruction.

The JSEP Taxonomy

The task of creating a strategies training program requires a taxonomy of curriculum-relevant component strategies. Gagne (1980) has argued that the universe of cognitive strategies is so diverse that it is virtually unteachable. However, when training of strategies is contextualized within the bounds of a metastrategy that has been chosen to fit a particular subject-matter curriculum, the burden of identifying a relevant set of component strategies is substantially eased. A taxonomy of component strategies was created specifically for JSEP. The JSEP taxonomy represents a synthesis of ideas borrowed from organizational frameworks created by Dansereau and his colleagues (1978), McCombs (1983), Weinstein (1982), and Vaughan (1981), as well as the authors' recent review of strategies literature.

The JSEP taxonomy is organized into five categories compatible with the previously discussed metastrategy:

1. Self-pacing methods,
2. Mood management techniques,
3. Comprehension strategies,
4. Memory strategies, and
5. Problem-solving techniques.

The self-pacing strategies are behavioral management "tricks," including techniques for setting and meeting realistic goals, time scheduling, self-reward, and systematic planning of study sessions. Mood management strategies, derived largely from clinical literature of Ellis (1963), Meichenbaum (1977) and others, are techniques that can help students establish an attitude early in a lesson, and maintain it throughout the instructional event. Mood management embodies positive self-talk, cognitive restructuring, and methods for reducing test anxiety and maintaining a high level of

concentration. Strategies in the goal-setting and mood management categories are similar to those listed by Dansereau as "support strategies." They are similar also to strategies incorporated by McCombs into her "motivational curriculum."

Strategies for comprehension, skilled memory and problem-solving are "primary strategies" in Dansereau's terminology, although his taxonomy does not include the problem-solving category. Comprehension strategies, derived largely from the work of Brown (1980), are self-monitoring skills that heighten awareness of and ability to deal with comprehension failure. Over fifty percent of the JSEP taxonomy is devoted to memory-enhancing and problem-solving strategies. Both of these categories raise controversial issues related to their role in skills acquisition, and thus will be discussed in some detail.

The Role of Verbal Learning in Skills Training

JSEP memorization strategies are divided into three categories:

1. Strategies for learning single terms and ideas (i.e., names and other proper nouns),

2. Strategies for lists (vocabulary lists, coding systems, etc.), and

3. Strategies for connected discourse (training manuals, for instance).

Single-term memorization strategies, based on the theoretical concept of within-item elaboration (Craik & Tulving, 1975; Cermak & Craik, 1979), include techniques that employ imagery and multiple analysis (e.g., spelling, defining, creating a sentence with vocabulary word) to increase the distinctiveness of encodings.

List learning strategies involve rehearsal (i.e., sequence chaining and self-testing), and use of encoding/retrieval methods based on the theoretical notion of between-item elaboration--mnemonic devices, chunking, and script schemas are examples.

Strategies for connected discourse employ key idea analysis, recoding techniques such as paraphrasing, and various forms of "between-item elaboration" (Wessells, 1982). Dansereau's networking technique is mentioned in this latter category, though it is considered too difficult for the JSEP environment.

At issue, however, is the appropriate role for these "verbal" (Gagne, 1980) learning strategies in the acquisition of the procedural-type knowledge that is the focus of a basic skills curriculum. One question, related to what Winograd (1975) has described as the "declarative-procedural debate," asks whether or not students should be required to memorize, as declarative information, procedural rules that govern skill performance. Learners often do not need to be able to state what they are doing in order to do it.

To illustrate this point, Gagne (personal communication) is fond of pointing out that children learn to formulate acceptable sentences without being able to state the rules of grammar. Furthermore, there is some evidence that memorizing procedural steps, such as might be derived from an information processing analysis of a mathematics skill, can interfere with learning and performance (Hendrix, 1960 as cited by Gagne and Dick, 1962).

On the other hand some theorists (e.g., Rumelhart & Norman, 1981) argue that intellectual skills (procedural knowledge) and verbal information (declarative knowledge) may be represented identically in semantic memory. At the very least, the human system apparently can interrogate "knowledge that," transforming it into "knowledge how," and vice versa. Thus, the procedure of placing a verbal "program" in a student's memory may provide a basis for an efficient training model, provided learners can be taught effective memorization and interrogation strategies.

There are other likely advantages of acquiring a skill as verbal information before learning to perform it. First, if the skill is explicitly and precisely codified, it may be "remembered" later, even after long periods of non-use. Another possible advantage is that an instructional designer can exert deliberate control over the construction of the skill memory representation, a power that might be used to affect the sophistication of a student's understanding and the efficiency of processing that utilizes the skill. A declarative encoding also may enable the learners to explain what they are doing, as well as to do it.

The Role of Problem-solving Strategies in Basic Skills Acquisition

Performance systems to be taught in JSEP vary widely in their complexity. Furthermore, some are algorithmic in the sense that they can be transferred into many job contexts without substantial alteration or modification, while others are much more difficult to represent as an invariant set of rules such as might be extracted from a task or information processing analysis of the skill. For example, in applying the skill of chart or graph reading, the to-be-deciphered chart can take on an infinite variety of complex forms. Though all charts bear a certain "family resemblance" to one another, a true prototype version simply does not exist. Consequently, the generic version of the skill which serves as the instructional example may differ from actual applications, both in terms of procedural steps and prerequisite competencies.

In many JSEP lessons, a recently learned procedural algorithm (the skill schema) must be adjusted by the learner to accommodate a number of variant contextual applications represented by practice problems. Each practice situation of this type can be viewed as an exercise requiring a problem-solving strategy. If transfer is conceptualized as a form of schema restructuring (Rumelhart & Norman, 1981), a number of the problem-solving techniques listed by Stanger (1982) in the CAPS taxonomy can be taught to JSEP students as learner strategies.

Examples include mapping a situation onto a prior knowledge schema or external model, and systematically searching for incompleteness, deviation, or mismatch. Trouble-shooting routines (i.e., ask an authority) are listed as problem-solving strategies. Also included are strategies involving systematic

elimination of alternatives and "working backward," which are useful for test-taking. In many ways, the problem-solving skills taught in JSEP are similar to those listed by Jones (1983) as strategies for dealing with inadequate and potentially confusing text conditions. Though the full universe of problem-solving techniques is so diverse that it is unteachable, as Gagne (1980) has argued, a few of these have been selected and included in JSEP as heuristic strategies for solving learning problems.

Incidental Strategies Training and the Principles of Instructional Design

As used in JSEP, the metastrategy technique assumes that the content-based lessons which comprise a curriculum are structurally compatible with one another and with the metastrategy. At the very least, lesson structures and the student's metastrategy should not operate in conflict. Many JSEP lessons were designed according to methods advocated by Gagne and Briggs (Briggs, 1977; Gagne & Briggs, 1974). Thus, it was necessary to adopt a metastrategy that could be mapped upon the Gagne and Briggs events of instruction. The important point is that addition of student-controlled strategies to the instructional situation did not eliminate the use of good instructional design principles that depend upon hidden controls.

Rather, JSEP students are taught strategies that should enhance the effectiveness of the instructional system. Consider, for example, the combined effectiveness of a designer's use of color to highlight key ideas, and a student's deliberate attempt to locate and encode key concepts. Whether or not the addition of an introductory course, metastrategies training, embedded prompts, or some combination of these significantly enhances learning over and above what is attained from well-designed instruction alone is an important issue that should be addressed experimentally as part of the JSEP evaluation.

It could be true that when strategies training is tied to a particular CBI system that has been thoughtfully sequenced and designed, learners will become system-dependent--unable to transfer learning skills into new situations that require them to deal with less adequate instructional conditions. Jones (1983) points out that strategies useful in one text design condition may be useless in another. However, training implemented within the context of a "text adequate" (Jones, 1983) curriculum may transfer to other learning situations that could be described as "text inadequate," provided strategies for transfer into simulated real-world problem situations are taught and practiced during training. The viability of this approach to transfer of strategies training also will be examined as part of the JSEP evaluation. But even if transfer of strategies training proves to be limited, it is not unreasonable to assume that within the military services, many aspects of training design could be standardized, at least for low-ability recruits. Improving a soldier's ability to function within a standardized instructional environment, or with a standard design for training manuals, is a viable goal, and currently may be the best possible approach for basic skills training in the US Army.

APPENDIX D

MEDIA SELECTION

MEDIUM SUGGESTED FOR PC

Prerequisite Competency	Media Suggested
NUMBERING AND COUNTING	
1a. Match numerals with word names and models	CBI plus audio
1b. Write numerals one through DN in sequential order from any starting point	CBI
1c. State what numeral comes after, before, or order from any starting point between any two given numerals	CBI
1d. Select the numeral which is greater/lesser order from any starting point from a set of numerals	CBI
1e. Identify an object with a specified ordinal order from any starting point position	CBI
1f. Write or state the place value of a particular digit, whole, or decimal number	CBI
1g. Round off a number to a specified place, digit, whole or decimal number	CBI
1h. Count by ones, twos, fives, tens, etc. backward or forward (skip counting)	CBI
1i Match numbers with points or intervals on a number line (positive (+) or negative (-) values)	CBI
LINEAR, WEIGHT, AND VOLUME MEASURES	
2a. Name the markings on a linear scale	CBI
2b. Differentiate units of measure and equivalents in the English and metric system	CBI
2c. Use a ruler, yardstick, meter stick, or scale to measure lengths of objects or distances	CBI plus real objects
2d. Identify measures of ounce, pound, gram	CBI
2e. Identify measures of pints, quarts, gallons,	CBI with off line measurement practice or video illustrations of concepts like gallons per minute

Prerequisite Competency	Media Suggested
2f. Use a scale which is not numerically calibrated	CBI
2g. Estimate measures of varying lengths, dimensions, or weights	CBI and possible supplement
DEGREE MEASURES	
3a. Identify degree or mil as a unit in determining direction, distance, or temperature	CBI
3b. Estimate the measure of a given angle not greater than 180 degrees	CBI
3c. Interpret bearings azimuth and other contexts in which the measure of an angle may range from 0 degrees to 360 degrees/0 to 6400 units	CBI
TIME-TELLING MEASURES	
4a. Use a 24-hour or digital clock to tell time	CBI
4b. Name intervals and tell time in hours, minutes, and seconds	CBI
4c. Estimate time in seconds, minutes, and parts of an hour	CBI
4d. Identify calendar units and arrange them in Julian style	CBI plus computer print out
Convert time into hours and tenths of hours	CBI
4f. Compute time using Greenwich Mean Time (GMT) as a basis for establishing zones and distances	CBI
GAGE MEASURES	
5a. Identify the unit of measurement found on an instrument	CBI
5b. Interpret the number, word, symbol from a display read-out	CBI
5c. Recognize a "reading" from a gauge with color divisions	CBI
5d. Recognize positive (+) and negative (-) demarcation on a scale	CBI

Prerequisite Competency	Media Suggested
5e. Select band(s) from a multi-scale gauge	CBI
5f. Match a gauge reading to a specification using numbered or labeled intervals	CBI
5g. Interpret gauge readings from an unnumbered/ unmarked interval	CBI
5h. Interpret a gauge reading which is fluctuating or momentarily sustained	CBI
5i. Match specifications of required measures by manipulation, alignment, or maintenance	CBI
SPATIAL	
6a. Identify directions that tools, hardware, or components may be moved	CBI with directed off-line practice
6b. Manipulate objects to align, match, mate, make parallel, be perpendicular, or be at an angle	CBI plus possible video supplement
6c. Interpret spatial relationships of figures and objects from 2-dimensional drawings, pictures, or photographs	CBI
6d. Relate geometric symbols and graphic representations to actual systems, subsystems, and components	CBI
LINES	
7a. Identify and name points, lines, rays, and segments	CBI
7b. Identify intersecting lines, parallel lines, and line segments	CBI
7c. Define and identify perpendicular lines	CBI plus possibly paper and pencil
7d. Identify congruent segments	CBI plus a compute generated print map and measuring instrument
PLANES	
8a. Identify and name plane geometric figures	CBI
8b. List the characteristics of geometric figures	CBI

Prerequisite Competency	Media Suggested
8c. Classify figures according to the number or measure of its sides or angles	CBI
8d. Identify figures which possess similarities	CBI
8e. Identify figures which may be parallel, perpendicular, or congruent	CBI
ANGLES AND TRIANGLES	
9a. Identify and name the different kinds of angles and triangles, with their corresponding figures	CBI
9b. Identify vertical, adjacent, complementary, or supplementary angles	CBI
9c. Classify triangles according to their sides or angle-size	CBI
9d. Identify altitudes and medians of triangles or the bisector of an angle	CBI
9e. Name an angle by using letters, a number, or a single letter	CBI
SOLIDS	
10a. Recognize and match the names of solids with their corresponding figures	CBI and interactive video
TERMINOLOGY	
11a. Identify technical words associated with geometric figures	CBI and interactive video
11b. Interpret meaning of terms derived from spatial orientation	CBI and interactive video
ADDITION AND SUBTRACTION	
12a. Add or subtract whole numbers, without carrying or borrowing	CBI
12b. Add or subtract whole numbers, carrying, and borrowing	CBI
12c. Add and subtract, borrowing, and carrying with mixed numbers (whole and decimals)	CBI
12d. Add or subtract positive (+) and negative (-) numbers, using a number line to arrive at a solution	CBI

Prerequisite Competency	Media Suggested
12e. Add or subtract to find correct time (24 hr. clock) using hours or minutes	CBI
12f. Add or subtract various increments on gages, dials, or any other measuring instrument	CBI
12g. Add or subtract time, linear, dry, liquid, or degree measures requiring regrouping	CBI
12h. Estimate a sum or difference	CBI
MULTIPLICATION AND DIVISION	
13a. Multiply and divide whole numbers	CBI
13b. Multiply and divide mixed numbers (whole and decimals)	CBI
13c. Divide a number with decimals in both divisor and dividend	CBI
13d. Multiply and divide integers, both positive (+) and negative (-), and assign proper sign to product or quotient	CBI
13e. Estimate a product or quotient	CBI
FRACTIONS/DECIMALS	
14a. Subdivide whole objects or a set of objects into halves (1/2), thirds (1/3), fourths (1/4), eighths (1/8)	CBI
14b. Reduce fractions to lowest terms	CBI
14c. Convert fractions (proper and improper) to decimal equivalents, and vice versa, using a table, chart, or gauge	CBI
14d. Compute equivalent value of fractions, decimals, percents, and mixed numbers to lowest terms	CBI and computer used as calculator
14e. Add and subtract fractions, with same or different denominators	CBI
14f. Multiply and divide fractions with and without whole numbers	CBI
14g. Estimate a fractional sum, product, or quotient	CBI

Prerequisite Competency	Media Suggested
GEOMETRY	
15a. Draw geometric figures, plane, and solid	CBI plus instructor and paper and pencil
15b. Match geometric figures with word names, equivalent measures	CBI
15c. Label all parts of geometric figures using mathematical and characteristic designators	CBI plus instructor and paper and pencil
15d. Use a protractor to measure angles, make geometrical constructions	CBI plus instructor and paper and pencil
15e. Construct perpendicular on a line segment, bisector of an angle	CBI plus instructor, compass or protractor, paper, and pencil
15f. Compute the perimeter and area of any figure	CBI
15g. Compute the circumference and area of a circle	CBI
15h. Compute the area and volume of any solid figure	CBI
15i. Use formulas in solving problems involving geometric figures	CBI
15j. Solve problems and interpret spatial relationships of figures, symbols, and objects from 2-dimensional displays	CBI
COMBINATION OF PROCESSES	
16a. Identify median and mode	CBI
16b. Compute averages	CBI
16c. Solve problems combining all processes using whole, mixed numbers, and fractions	CBI
16d. Solve problems, combining all processes, involving units of measurement	CBI
16e. Interpret information from charts, number lines, scales, and graphs to solve arithmetic problems	CBI
16f. Solve conversion problems of linear (metric and Englgh (liquid, weight, and temperature (F degree or C degree) measures	CBI

Prerequisite Competency	Media Suggested
16g. Solve problems involving ratio and proportion	CBI
16h. Solve word problems where any mathematical illustrations	CBI
GRAPHING IN THE COORDINATE PLANE	
17a. Identify coordinates of a point in any grid system	CBI
17b. Identify points on a line graph	CBI
17c. Match a graph with its equation	CBI
ALGEBRA	
18a. Solve simple algebraic equations with one unknown	CBI
18b. Recognize and derive equivalent algebraic expressions	CBI
18c. Evaluate powers and estimate roots	CBI
TRIGONOMETRY	
19a. Use tables of trigonometric functions	CBI
19b. Use tables of logarithms to solve problems	CBI plus computer generated printed supplements
19c. Solve geometric problems using trigonometric functions	CBI
19d. Use trigonometric ratios to solve problems	CBI
PROCEDURAL DIRECTIONS	
25a. Identify factual details or specifications that are found within a statement or written selection	CBI
25b. Select parts of text and visual materials to complete a task activity	CBI
25c. Follow highly-detailed, step-by-step directions in order to accomplish a sequence of task activities	CBI plus instructor
25d. Determine the essential message of a paragraph or section of written material	CBI

Prerequisite Competency	Media Suggested
25e. Infer from a written source, which does not explicitly provide required information, in order to make a decision	CBI
25f. Synthesize information from written sources which contributes to the completion of a task activity	CBI
VOCABULARY	
26a. Recognize common words and their meanings	CBI
26b. Recognize task-related words with technical meanings	CBI
26c. Identify the correct meaning of a word from the context of a sentence	CBI
26d. Recognize the meaning of common contractions, abbreviations, and acronyms	CBI
26e. Determine the meaning of figurative, idiomatic, and technical terms by using context clues or by using a reference source(s)	CBI
REFERENCE SKILLS	
27a. Locate a Technical Manual, Field Manual, or any related source document by code number and title	CBI
27b. Alphabetize words or topics to locate information	CBI
27c. Use the table of contents, index, system, or sub-system heading, appendix, and glossary to locate information	CBI with audio and paper supplement printed from computer
27d. Locate the page, title, paragraph, figure, or chart needed to answer a question or to solve a problem	CBI
27e. Determine, after scanning or skim-reading, whether the information is relevant	CBI
27f. Cross-reference within and across source documents to select information needed to perform a routine	CBI with paper supplement printed by computer
27g. Organize information from multiple sources into a sequenced series of events	CBI with audio

Prerequisite Competency	Media Suggested
TABLES/CHARTS	
28a. Obtain a fact or specification from a two-column table or chart to find information	CBI
28b. Obtain a fact or specification from an intersection of a row by column table or chart	CBI
28c. Use a complex table or chart requiring cross-referencing within or in combination with text material outside the chart	CBI with paper supplement printed by computer
28d. Apply information from tables and charts for locating malfunctions, or for selecting a course of action	CBI with print supplement of complex charts
ILLUSTRATIONS	
29a. Identify details, labels, numbers, and parts from an illustration or picture	CBI with supplemental paper copies of photographs
29b. Identify parts or details according to a key or legend	CBI
29c. Interpret a drawing which shows a cross-sectional view of an object for assembly, disassembly	CBI with interactive video, portable equipment, or training aids
29d. Interpret a three dimensional projection or exploded view of object(s) for assembly, disassembly, or position in system or sub-system	CBI with interactive video, portable equipment, and training aids
29e. Follow illustrations, or photographs, arranged in a sequential order, as a guide	CBI plus video or photographs
29f. Integrate information from various sources to select a course of action	CBI
FLOW CHARTS	
30a. Use a simple linear path of an organizational chart to list events in sequential order	CBI
30b. Use a linear path of a flow chart to provide visual and textual directions to a procedure, to arrive at decision points, and to provide alternate paths in problem-solving	CBI
30c. Translate the significance of the symbols into physical activities	CBI

Prerequisite Competency	Media Suggested
SCHEMATICS	
31a. Isolate each major section or entity presented in a schematic diagram	CBI
31b. Identify the components within each entity	CBI
31c. Trace connections in an integrated circuit from their origin to another point within or from one entity to another	CBI
31d. Isolate a problem component in a schematic and trace it to components believed to cause the problem	CBI and printer
31e. Interpret symbols to indicate direction of flow, test points, components, and diagrammatic decision points	CBI
FORMS	
32a. Locate the block on a form to enter the appropriate information	CBI
32b. Transfer a number, code, date, figure, or related data from equipment or written sources onto an appropriate section of the form	CBI with some off-line practice and testing.
32c. Write the name of the organization, responsible personnel, disposition of the part or equipment, and nomenclature, in appropriate sections of the form	CBI with some off-line practice
32d. Write a descriptive account of an activity or transaction performed	CBI with instructor review of off-line practice problems
32e. Use a completed form to locate or compare information	CBI with off-line practice problems
NOTE-TAKING	
33a. Distinguish between essential and non-essential details during the note-taking process	CBI
33b. Record details without misinterpreting the intent of either written material or an interview	CBI
33c. Rewrite all recorded details in sentence form	CBI with instructor evaluation

Prerequisite Competency	Media Suggested
33d. Organize all sentences into paragraphs	CBI with instructor evaluation
OUTLINING (topic or sentence)	
34a. Distinguish between major and subordinate topics	CBI
34b. Generate titles for each major topic selected	CBI
34c. Use phrases or sentences to provide subordinate details under each major topic	CBI
34d. Alternate, indent numbers, and letters to establish a hierarchy	CBI
REPORT WRITING	
35a. State the intent or objective(s) of the report	CBI
35b. Describe the parameters of the event or situation	CBI
35c. Distinguish between relevant and irrelevant details	CBI
35d. Sequence events in the order they have occurred	CBI with video interface
35e. State general impressions of events described	CBI with instructor evaluation
35f. Select examples that will clarify major issues presented in the report	CBI with instructor evaluation
35g. Examine opposing points of view in the report	CBI
35h. Summarize the major points developed in the report	CBI with instructor evaluation
35i. Justify an action taken and give reasons for rejecting alternatives	CBI
EDITING	
36a. Spell frequently used words correctly	CBI and possibly hand-held tutor
36b. Spell task-related words correctly	CBI and possibly hand-held tutor
36c. Identify words that need to be capitalized	CBI

Prerequisite Competency	Media Suggested
36d. Correct all misspelled words with or without the use of a reference source	CBI and reference sources (dictionary, manuals, etc.)
36e. Apply all rules for end marks, commas, and apostrophes	CBI
36f. Apply common rules of grammar	CBI
36g. Rewrite the paragraph by stating the main idea in the first sentence, and restructuring the sentences for coherence	CBI and supplement paper
36h. Appraise an entire written communication and make adjustments to improve clarity	CBI and practice including off-line responses to be graded by the instructor
TYPE	
37a. Individual - a person working on a task and communicating with another when assistance is needed or when a supervisory decision is needed	Not analyzed
37b. Instruction - a task activity requiring communication between an instructor, an individual or small group where the purpose is to give facts or rules to inform or guide	Not analyzed
37c. Tutor - interaction takes place betwen two persons where one is instructing and the other is doing the task	Not analyzed
37d. Peer Group (less than 10) - all members engage in an activity where one person assumes a leadership role and communicates to others what is to be done	Not analyzed
37e. Interview - a person communicating with another about his activities, opinions, or subject exkpertise for the purpose of using the information in a task	Not analyzed
37f. Briefing - communicating final instructions to others or giving an account in summary	Not analyzed
37g. Counsel - communicating together to exchange ideas or opinions to recommend, give or take advice, or to arrive at an acceptance of a plan or decision	Not analyzed

Prerequisite Competency	Media Suggested
37h. Command - communicate to others an order or action to be taken wher a person has a positin of authority	Not analyzed
CHARACTERISTICS	
38a. Enunciate clearly, using the proper rate of speech	Not analyzed
38b. Use technical vocabulary suitable to the task and level of the person	Not analyzed
38c. Determine the appropriate amount of information to communicate	Not analyzed
38d. Interpret figurative or idiomatic language by reference to its use in context	Not analyzed
38e. Follow highly detailed, step-by-step directions	Not analyzed
38f. Solicit feedback to confirm the accurate reception of the communication	Not analyzed
38g. Recognize when a low-key, informal dialogue is suitable	Not analyzed
38h. Recognize when direct verbal commands are necessary	Not analyzed
38i. Recognize when a prescribed series of verbal interactions is required to coordinate a group effort	Not analyzed
38j. Recognize when the situation will require a structured, preplanned method of presentation	Not analyzed
BARRIERS	
39a. Recognize the need for clear, concise directions in order to prevent injury to self or equipment	Not analyzed
39b. Recognize personality facotrs and interpersonal relationships that may exist	Not analyzed
39c. Recognize feedback as a means of communicating more effectively and increasing task competence	Not analyzed

Prerequisite Competency	Media Suggested
PRECAUTIONS	
40a. Use common knowledge to avoid hazards in order to prevent injury to self or equipment	CBI
40b. Apply preventive measures prior to task performance to minimize any potential safety or security problem	CBI
40c. Select an appropriate course of action in the event of an emergency	CBI
RECOGNITION	
41a. Identify similarities and differences between and among objects	CBI and videodisc, videotape, portable equipment, or training aid
41b. Use body language (motions, gestures, postures) to communicate or signal	Videotape or CBI and videodisc, plus instructor for motor practice feedback
41c. Determine the presence of a defect or extent of damage	CBI interactive video, portable equipment, or training aids
41d. Match objects by size, shape, color, and significant markings	CBI and interactive video
41e. Classify objects by size, shape, color, and significant markings	CBI and interactive video
41f. Determine direction, duration, and intensity of sounds, sightings, and smells	CBI interactive videodisc, portable equipment, or simulator
41g. Infer from sights, sounds, touch, smells, or tastes to determine a course of action	CBI and interactive videodisc
41h. Interpret codes and symbols	CBI

APPENDIX E

JSEP LESSON SPECIFICATIONS

JSEP LESSON SPECIFICATIONS

1. LESSON DESIGNATORS:

   A. TICCIT DESIGNATOR:

   B. PLATO DESIGNATOR:

2. TITLE:

3. PREREQUISITE COMPETENCY NUMBER:

4. PREREQUISITE COMPETENCY STATEMENT:

5. MOS's FOR WHICH LESSON APPLIES (indicated by *):

05B	17K	43M	63W	71Q
05C	19D	44B	64C	72E
05G	19E	44E	67G	74D
11B	24C	45B	67N	74F
11C	24H	45K	67T	75B
11H	26L	52C	67U	76B
11M	26Q	52D	67V	76C
12B	27E	54E	67Y	76P
13B	31J	55B	68B	76V
13E	31M	55D	68D	76W
13F	31N	57E	68F	76X
15D	31V	57H	68G	76Y
15E	32D	61B	68H	82C
16D	32H	61C	68J	91P
16E	33S	62B	68M	91C
16H	35K	62E	71D	93J
16P	36C	63G	71L	94B
17B	36K	63H	71M	95B
17C	43E	63N	71P	95C
				96B
				COMMON

6. LEARNING TASK ANALYSIS AND ENTRY SKILLS:

   On File at CET.

7. MOS SPECIFIC INDICATOR STATEMENTS RELATED TO THIS PREREQUISITE COMPETENCY:

   See Attachment 7.

8. ETS TEST ITEMS:

A. ETS TEST ITEMS:

See Attachment 8A.

B. ANALYSIS OF ETS TEST ITEMS:

See Attachment 8B.

9. TERMINAL LEARNING OBJECTIVE AND LEARNING OBJECTIVES:

See Attachment 9.

10. DOMAIN(S) AND LEVEL(S) OF LEARNING IN LESSON (indicated by *):

VERBAL INFORMATION
- LABELS
- FACTS
- CONNECTED DISCOURSE

MOTOR SKILLS
ATTITUDES
PROBLEM SOLVING
INTELLECTUAL SKILLS
- DISCRIMINATIONS
- CONCRETE CONCEPTS
- DEFINED CONCEPTS
- RULES

11. OUTCOME OF MEDIA SELECTION MODEL:

Computer based instruction.

12. ESTIMATED LEARNER TIME:

13. CONTENT SUMMARY:

14. SPECIAL COMMENTS ON PRESENTATION OF SKILLS AND KNOWLEDGE:

15. COMMON LEARNER ERRORS:

16. INDICATED REVISIONS BASED ON TRYOUTS:

17. PRACTICE AND FEEDBACK ACTIVITIES:

    A. GENERIC:

    B. MOS SPECIFIC COMPONENTS:

18. CONTENT GRAPHICS SUGGESTIONS:

19. PSYCHOLOGICAL CONSIDERATIONS:

20. IMPLICATIONS/CONSIDERATIONS FOR DELIVERY SYSTEM IMPLEMENTATION:

A. PLATO:

B. MICROTICCIT:

ATTACHMENT 7: MOS SPECIFIC INDICATOR STATEMENTS

MOS	Example Indicator Statements

ATTACHMENT 8B: ANALYSIS OF ETS TEST ITEMS

TEST ITEMS BY ETS TEST

Test:

Item
Numbers:

ITEM RATING BY TEST

	Good	Fair	Poor
TEST			

COMMENTS

ETS Test	Item Number	Comments

ATTACHMENT 9: TERMINAL LEARNING
OBJECTIVE AND LEARNING OBJECTIVES

Terminal Learning Objective:

Learning Objectives:

1.

APPENDIX F

TRADOC Prerequisite Competency Study

Prerequisite Competency	DOD	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
NUMBERING AND COUNTING					
1a. Match numerals with word names and models	+	95	62	27	48
1b. Write numerals one through N in sequential order from any starting point	+	60	45	33	32
1c. State what numeral comes after, before, or between any two given numerals	+	81	52	31	42
1d. Select the numeral which is greater/lesser from a set of numerals	+	69	55	32	48
1e. Identify an object with a specified ordinal position	+	74	74	16	42
1f. Write or state the place value of a particular digit, whole or decimal number	+	63	68	19	48
1g. Round off a number to a specified place, whole or decimal		51	47	31	45
1h. Count by ones, twos, fives, tens, etc. backward or forward (skip counting)	+	95	49	22	41

Prerequisite Competency	OOO	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
1i. Match numbers with points or intervals on a number line (positive (+) or negative (-) values)	+	37	65	24	41
LINEAR, WEIGHT, AND VOLUME MEASURES					
2a. Name the markings on a linear scale	+	37	65	27	46
2b. Differentiate units of measure and equivalents in the English and metric system	+	59	56	17	42
2c. Use a ruler, yardstick, meter stick or scale to measure lengths of objects or distances	+	77	66	22	51
2d. Identify measures of ounce, pound, gram		43	40	33	47
2e. Identify measures of pints, quarts, gallons, liters	+	39	46	23	28
2f. Use a scale which is not numerically calibrated	+	43	70	14	28
2g. Estimate measures of varying lengths, dimensions or weights	+	90	61	16	47

Prerequisite Competency	DOD	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
DEGREE MEASURES					
3a. Identify degree as a unit or mil in determining direction, distance or temperature	+	64	66	19	52
3b. Estimate the measure of a given angle not greater than 180 degrees	+	50	62	14	18
3c. Interpret bearings azimuth and other contexts in which the measure of an angle may range from 0 degrees to 360 degrees/0 to 6400 mils	+	52	54	17	60
TIME-TELLING MEASURES					
4a. Use a 24-hour or digital clock to tell time	+	59	44	25	31
4b. Name intervals and tell time in hours, minutes, and seconds	+	71	54	25	35
4c. Estimate time in seconds, minutes, and parts of an hour	+	85	52	21	27
4d. Identify calendar units and arrange them in Julian style	+	74	50	04	36
4e. Convert time into hours and tenths of hours		22	50	23	32
4f. Compute time using Greenwich Mean Time (GMT) as a basis for establishing zones and distances		12	75	25	33

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
GAUGE MEASURES					
5a. Identify the unit of measurement found on an instrument	+	82	01	17	54
5b. Interpret the number, word, symbol from a display read-out		63	67	11	46
5c. Recognize a "reading" from a gauge with color divisions	+	55	64	15	29
5d. Recognize positive (+) and negative (-) demarcation on a scale		40	73	13	43
5e. Select band(s) from a multi-scale gauge		37	78	03	38
5f. Match a gauge reading to a specification using numbered or labeled intervals	+	68	74	13	47
5g. Interpret gauge readings from an unnumbered/unmarked interval	+	55	62	05	35
5h. Interpret a gauge reading which is fluctuating or momentarily sustained	+	55	75	05	45

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
5i. Match specifications of required measures by manipulation, alignment or maintenance	+	59	78	02	49
SPATIAL					
6a. Identify directions that tools, hardware, or components may be moved	+	91	77	12	46
6b. Manipulate objects to align, match, mate, make parallel, be perpendicular or be at an angle	+	91	80	04	54
6c. Interpret spatial relationships of figures and objects from 2-dimensional drawings, pictures, or photographs	+	47	64	13	49
6d. Relate geometric symbols and graphic representations to actual systems, subsystems and components	+	41	76	10	51
LINES					
7a. Identify and name points, lines, rays, and segments	+	43	58	16	56

Prerequisite Competency	OOO	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
7b. Identify intersecting lines, parallel lines, and line segments	+	46	65	15	61
7c. Define and identify perpendicular lines	+	27	41	30	41
7d. Identify congruent segments		11	45	18	45
PLANES					
8a. Identify and name plane geometric figures	+	36	44	14	39
8b. List the characteristics of geometric figures		8	38	13	25
8c. Classify figures according to the number or measure of its sides or angles		10	20	20	80
8d. Identify figures which possess similarities	+	33	58	21	55
8e. Identify figures which may be parallel, perpendicular or congruent		18	50	17	44
ANGLES AND TRIANGLES					
9a. Identify and name the different kinds of angles and triangles, with their corresponding figures	+	43	53	19	47

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
9b. Identify vertical, adjacent, complementary or supplementary angles		23	61	17	48
9c. Classify triangles according to their sides or angle-size		7	29	14	29
9d. Identify altitudes and medians of triangles or the bisector of an angle	+	10	90	0	20
9e. Name an angle by using letters, a number, or a single letter		4	50	0	25
SOLIDS					
10a. Recognize and match the names of solids with their corresponding figures	+	13	54	15	62
TERMINOLOGY					
11a. Identify technical words associated with geometric figures	+	70	67	11	47
11b. Interpret meaning of terms derived from spatial orientation	+	66	68	11	47
ADDITION AND SUBTRACTION					
12a. Add or subtract whole numbers, without carrying or borrowing	+	60	43	37	45

Prerequisite Competency	JOD	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
12b. Add or subtract whole numbers, carrying and borrowing	+	51	51	31	55
12c. Add and subtract, borrowing and carrying with mixed numbers (whole and decimals)		43	42	51	67
12d. Add or subtract positive (+) and negative (-) numbers, using a number line to arrive at a solution		49	59	22	59
12e. Add or subtract to find correct time (24 hr. clock) using hours or minutes	+	15	53	20	53
12f. Add or subtract various increments on gauges, dials, or any other measuring instrument	+	33	70	18	58
12g. Add or subtract time, linear, dry, liquid or degree measures requiring regrouping		18	67	22	61
12h. Estimate a sum or difference	+	28	50	32	39
MULTIPLICATION AND DIVISION					
13a. Multiply and divide whole numbers	+	60	50	30	57
13b. Multiply and divide mixed numbers (whole and decimals)		41	41	44	59

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
13c. Divide a number with decimals in both divisor and dividend		6	50	50	83
13d. Multiply and divide integers, both positive (+) and negative (-), and assign proper sign to product or quotient		36	42	17	58
13e. Estimate a product or quotient		25	44	28	44
FRACTIONS/DECIMALS					
14a. Subdivide whole objects or a set of objects into halves (1/2), thirds (1/3), fourths (1/4), eighths (1/8)	+	69	54	25	43
14b. Reduce fractions to lowest terms		6	50	17	50
14c. Convert fractions (proper and improper) to decimal equivalents, and vice versa, using a table, chart or gauge		18	17	33	56
14d. Equivalent value of fractions, decimals, percents, and mixed numbers to lowest terms	+	54	39	28	61
14e. Add and subtract fractions, with same or different denominators		20	25	40	55
14f. Multiply and divide fractions with and without whole numbers		13	15	38	69

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
14g. Estimate a fractional sum, product, or quotient		22	55	32	55
GEOMETRY					
15a. Draw geometric figures, plane and solid	+	35	43	20	34
15b. Match geometric figures with word names, equivalent measures	+	61	54	18	46
15c. Label all parts of geometric figures using mathematical and characteristic designators		8	63	0	38
15d. Use a protractor to measure angles, make geometrical constructions	+	47	70	11	60
15e. Construct perpendicular on a line segment, bisector of an angle		3	100	0	67
15f. Compute the perimeter and area of any figure		22	36	27	64
15g. Compute the circumference and area of a circle		6	0	50	50
15h. Compute the area and volume of any solid figure		3	33	67	

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
15i. Use formulas in solving problems involving geometric figures		7	43	43	57
15j. Solve problems and interpret spatial relationships of figures, symbols, and objects from 2-dimensional displays		34	62	09	56
COMBINATION OF PROCESSES					
16a. Identify median and mode		5	60	40	60
16b. Compute averages	+	27	33	33	59
16c. Solve problems combining all processes using whole, mixed numbers and fractions		13	54	31	77
16d. Solve problems, combining all processes, involving units of measurement		14	64	21	57
16e. Interpret information from charts, number lines, scales and graphs to solve arithmetic problems		17	59	24	53
16f. Solve conversion problems of linear (metric and English (liquid, weight, and temperature (F degree or C degree) measures		32	44	38	69

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
16g. Solve problems involving ratio and proportion	+	37	51	16	59
16h. Solve word problems where any mathematical process may occur		6	67	33	67
GRAPHING IN THE COORDINATE PLANE					
17a. Identify coordinates of a point in any grid system	+	39	67	10	54
17b. Identify points on a line graph	+	34	65	15	50
17c. Match a graph with its equation		3	67	33	33
ALGEBRA					
18a. Solve simple algebraic equations with one unknown		27	67	22	74
18b. Recognize and derive equivalent algebraic expressions		3	100	0	100
18c. Evaluate powers and estimate roots		4	75	0	50
TRIGONOMETRY					
19a. Use tables of trigonometric functions		3	100	0	100

Prerequisite Competency	OOO	Number of MOS	Already Taught %	Highest Priority %	*Difficulty* %
19b. Use tables of logarithms to solve problems		4	75	0	75
19c. Solve geometric problems using trigonometric functions		3	100	0	100
19d. Use trigonometric ratios to solve problems		2	100	0	100
PROCEDURAL DIRECTIONS					
25a. Identify factual details or specifications that are found within a statement or written selection	+	92	71	20	60
25b. Select parts of text and visual materials to complete a task activity	+	85	73	14	59
25c. Follow highly-detailed, step-by-step directions in order to accomplish a sequence of task activities	+	91	79	13	69
25d. Determine the essential message of a paragraph or section of written material		48	63	29	81
25e. Infer from a written source, which does not explicitly provide required information, in order to make a decision		48	52	15	65

Prerequisite Competency	DOD	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
25f. Synthesize information from written sources which contributes to the completion of a task activity		33	61	27	61
VOCABULARY					
26a. Recognize common words and their meanings	+	64	61	31	44
26b. Recognize task-related words with technical meanings	+	76	89	04	55
26c. Identify the correct meaning of a word from the context of a sentence	+	55	60	33	49
26d. Recognize the meaning of common contractions, abbreviations and acronyms	+	84	74	13	54
26e. Determine the meaning of figurative, idiomatic, and technical terms by using context clues or by using a reference source(s)	+	77	70	13	49
REFERENCE SKILLS					
27a. Locate a Technical Manual, Field Manual or any related source document by code number and title	+	90	77	08	53
27b. Alphabetize words or topics to locate information		49	47	18	37

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
27c. Use the table of contents, index, system or sub-system heading, appendix and glossary to locate information	+	77	84	09	57
27d. Locate the page, title, paragraph, figure, or chart needed to answer a question or to solve a problem	+	77	77	09	55
27e. Determine, after scanning or skim-reading, whether the information is relevant	+	69	46	29	59
27f. Cross-reference within and across source documents to select information needed to perform a routine	+	71	69	07	62
27g. Organize information from multiple sources into a sequenced series of events		42	69	12	57
TABLES/CHARTS					
28a. Obtain a fact or specification from a two-column table or chart to find information	+	81	74	06	59
28b. Obtain a fact or specification from an intersection of a row by column table or chart	+	94	76	09	55

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
28c. Use a complex table or chart requiring cross-referencing within or in combination with text material outside the chart		66	74	08	64
28d. Apply information from tables and charts for locating malfunctions, or for selecting a course of action	+	84	77	05	61
ILLUSTRATIONS					
29a. Identify details, labels, numbers, and parts from an illustration or picture	+	84	75	14	51
29b. Identify parts or details according to a key or legend	+	54	83	13	61
29c. Interpret a drawing which shows a cross-sectional view of an object for assembly, disassembly	+	39	79	10	67
29d. Interpret a three dimensional projection or exploded view of object(s) for assembly, disassembly, or position in system or sub-system	+	31	61	0	58
29e. Follow illustrations, or photographs, arranged in a sequential order, as a guide	+	49	69	18	51

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
29f. Integrate information from various sources to select a course of action		45	67	16	51
FLOW CHARTS					
30a. Use a simple linear path of an organizational chart to list events in sequential order		9	78	0	44
30b. Use a linear path of a flow chart to provide visual and textual directions to a procedure, to arrive at decision points, and to provide alternate paths in problem-solving		22	64	09	59
30c. Translate the significance of the symbols into physical activities		4	75	0	75
SCHEMATICS					
31a. Isolate each major section or entity presented in a schematic diagram		18	89	0	61
31b. Identify the components within each entity		19	84	05	68
31c. Trace connections in an integrated circuit from their origin to another point within or from one entity to another		19	95	05	74

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
31d. Isolate a problem component in a schematic and trace it to components believed to cause the problem		14	93	0	64
31e. Interpret symbols to indicate direction of flow, test points, components and diagrammatic decision points		16	81	0	69
FORMS					
32a. Locate the block on a form to enter the appropriate information	+	77	86	08	48
32b. Transfer a number, code, date, figure or related data from equipment or written sources onto an appropriate section of the form	+	79	82	06	44
32c. Write the name of the organization, responsible personnel, disposition of the part or equipment, and nomenclature, in appropriate sections of the form	+	75	77	07	45
32d. Write a descriptive account of an activity or transaction performed	+	78	72	14	51
32e. Use a completed form to locate or compare information	+	86	74	07	55

Prerequisite Competency	OOO	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
NOTE-TAKING					
33a. Distinguish between essential and non-essential details during the note-taking process		38	55	26	53
33b. Record details without misinterpreting the intent of either written material or an interview	+	67	60	18	63
33c. Rewrite all recorded details in sentence form		14	21	29	50
33d. Organize all sentences into paragraphs		8	50	0	25
OUTLINING (topic or sentence)					
34a. Distinguish between major and subordinate topics		5	40	20	60
34b. Generate titles for each major topic selected		8	25	50	63
34c. Use phrases or sentences to provide subordinate details under each major topic		4	50	50	75
34d. Alternate, indent numbers and letters to establish a hierarchy	+	5	20	0	40

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
REPORT WRITING					
35a. State the intent or objective(s) of the report		12	42	25	58
35b. Describe the parameters of the event or situation	+	20	40	10	40
35c. Distinguish between relevant and irrelevant details		24	50	25	54
35d. Sequence events in the order they have occurred	+	17	53	24	47
35e. State general impressions of events described	+	13	46	23	31
35f. Select examples that will clarify major issues presented in the report	+	8	25	13	50
35g. Examine opposing points of view in the report		1	1	0	0
35h. Summarize the major points developed in the report	+	14	14	29	57
35i. Justify an action taken and give reasons for rejecting alternatives		4	50	25	25

Prerequisite Competency	DOD	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
EDITING					
36a. Spell frequently used words correctly		12	33	33	33
36b. Spell task-related words correctly		47	30	23	53
36c. Identify words that need to be capitalized		5	20	40	80
36d. Correct all misspelled words with or without the use of a reference source		15	20	20	67
36e. Apply all rules for end marks, commas, and apostrophes		10	30	60	90
36f. Apply common rules of grammar		13	46	23	54
36g. Rewrite the paragraph by stating the main idea in the first sentence, and restructuring the sentences for coherence		2	50	50	50
36h. Appraise an entire written communication and make adjustments to improve clarity		31	39	16	35

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
TYPE					
37a. Individual - a person working on a task and communicating with another when assistance is needed or when a supervisory decision is needed	+	77	62	13	43
37b. Instruction - a task activity requiring communication between an instructor, an individual or small group where the purpose is to give facts or rules to inform or guide	+	54	65	13	46
37c. Tutor - interaction takes place between two persons where one is instructing and the other is doing the task	+	30	67	13	40
37d. Peer Group (less than 10) - all members engage in an activity where one person assumes a leadership role and communicates to others what is to be done	+	58	53	05	40
37e. Interview - a person communicating with another about his activities, opinions, or subject expertise for the purpose of using the information in a task	+	26	58	19	42
37f. Briefing - communicating final instructions to others or giving an account in summary	+	30	43	23	40

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
37g. Counsel - communicating together to exchange ideas or opinions to recommend, give or take advice, or to arrive at an acceptance of a plan or decision	+	24	46	17	33
37h. Command - communicate to others an order or action to be taken where a person has a position of authority	+	40	60	13	43
CHARACTERISTICS					
38a. Enunciate clearly, using the proper rate of speech	+	37	62	16	41
38b. Use technical vocabulary suitable to the task and level of the person	+	56	61	11	39
38c. Determine the appropriate amount of information to communicate	+	48	65	13	50
38d. Interpret figurative or idiomatic language by reference to its use in context	+	22	64	14	27
38e. Follow highly detailed, step-by-step directions		36	83	14	56

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
38f. Solicit feedback to confirm the accurate reception of the communication	+	47	74	17	49
38g. Recognize when a low-key, informal dialogue is suitable	+	20	50	15	30
38h. Recognize when direct verbal commands are necessary	+	26	65	12	46
38i. Recognize when a prescribed series of verbal interactions is required to coordinate a group effort	+	40	63	13	48
38j. Recognize when the situation will require a structured, preplanned method of presentation	+	25	40	16	52
BARRIERS					
39a. Recognize the need for clear, concise directions in order to avoid language or word-meaning differences	+	31	61	19	42
39b. Recognize personality factors and inter-personal relationships that may exist	+	18	50	06	50

Prerequisite Competency	DOD	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
39c. Recognize feedback as a means of communicating more effectively and increasing task competence	+	33	55	15	39
PRECAUTIONS					
40a. Use common knowledge to avoid hazards in order to prevent injury to self or equipment	+	90	79	06	50
40b. Apply preventive measures prior to task performance to minimize any potential safety or security problem	+	87	85	02	51
40c. Select an appropriate course of action in the event of an emergency	+	58	79	02	50
RECOGNITION					
41a. Identify similarities and differences between and among objects	+	90	81	08	53
41b. Use body language (motions, gestures, postures) to communicate or signal	+	62	55	02	34
41c. Determine the presence of a defect or extent of damage	+	77	86	01	51
41d. Match objects by size, shape, color and significant markings	+	78	74	12	42

Prerequisite Competency	000	Number of MOS	Already Taught %	Highest Priority %	Difficulty %
41e. Classify objects by size, shape, color and significant markings	+	90	76	08	48
41f. Determine direction, duration, and intensity of sounds, sightings and smells	+	90	63	06	42
41g. Infer from sights, sounds, touch, smells, or tastes to determine a course of action	+	88	68	05	44
41h. Interpret codes and symbols	+	69	83	13	48